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CONTENTS.

ILLUSTRATED ARTICLES: PAGE.
Cuttriss' Improved Siphon Recorder for Ocean Cables. 228
Field's Electric Locomotive. 229
The Ries "Combination" Conduit for Electric Street Railways. 233
Daft's Method of Starting Electric Motors 234

CORRESPONDENCE:
Spur Gearing for Electric Street Cars. 229

EDITORIAL PARAGRAPHS. 227

MISCELLANEOUS.
The Woonsocket Electric Railway. 228
The Philadelphia Street Railway Convention. 230
Lightning Conductors. 233
Notes on the American Institute Electrical Exhibition. 233

MISCELLANEOUS: PAGE.
The Dissolution of the Pan Electric Company. 233
The Advantages of Gas Companies Engaging in the Electric Light Business. 234
Meeting of the New York Electrical Society. 234
Gas Companies and Electric Lighting. 234

DEPARTMENTS:
New York Notes. 235
New England Notes. 235
Philadelphia Notes. 236
Western Notes. 236
The Telegraph. 237
The Telephone. 237
The Electric Light. 238
Applications of Power. 239
Miscellaneous Notes. 239
Personals. 239
Business Notices. 239
Our Illustrated Record of Electrical Patents. 240

New Advertisements.

In the growth of THE ELECTRICAL WORLD in circulation, size and general improvement, the value of its columns for reaching those engaged in electrical pursuits or interested in electrical matters has not failed to be appreciated by advertisers. Readers will find it to their advantage to keep their eyes on the advertising as well as the reading columns. The following are the new advertisements in this issue:

PAGE.
The Thomson-Houston Electric Co.—The Thomson-Houston Electric Motor for Street Railways. ii
Shaw & Geary.—New Electric Buzzer. vi
F. Jarvis Patten.—Some New Electrical Inventions. 240
The Shaver Corporation.—Shaver's Standard Telephone. 240
The Electric Gas Lighting Co.—The "Victor" Wooden Box Bell. ix
Wants, For Sale and Special Notices. ix

VOL. X. NEW YORK, OCTOBER 29, 1887. No. 18.

WE present this week a very full report of the proceedings of the street railway convention at Philadelphia on the 19th, 20th and 21st inst. As will be seen, the use of electricity was discussed at every session, electric motors being, in fact, the most important topic coming up for consideration this year. The significance of this it would be difficult to exaggerate. Heretofore the American Street Railway Association has devoted most of its time at these meetings to such matters as the care of horses and the advantages of the cable, but now there is a complete change of front, and the all-absorbing theme is electricity. We need not apologize therefore for the extent at which we report the convention proceedings; on the contrary, our readers will appreciate this renewed evidence of enterprise, and will find much to occupy their thoughts in the new departure which is thus so remarkably shown to be taking place in the street railway business. While they might not care much about the treatment of spinal meningitis in the poor car horse, they have all a lively interest in the electric motor that is so rapidly taking his place, and in the many different methods by which the current is furnished to the moving car.

THE wide reach of electrical applications was well exemplified last week when, while the street car men at Philadelphia were learning with eagerness how to apply the electric motor to their roads, the members of the American Gas Light Association meeting in New York were listening with equal avidity to the arguments of Mr. King in favor of their becoming purveyors of electric light. We print Mr. King's pithy paper elsewhere. It is worth reading. It makes a number of good points, and may be taken as fairly expressive of the sentiments of a growing number of gas companies in all parts of the country.

IN spite of many rumors to the contrary, the Chinese-American telephone and banking syndicate still retains the concession granted to it, and early active work in developing this new territory is promised. We must confess that to us it looks as though the syndicate will pay more attention to banking than to telephony. The old corporation in this city which obtained banking powers from the State, under the guise of a franchise to supply water for Manhattan Island, has been taken as an exemplar. It is even reported that Mr. Wharton Barker's company has in mind a project for building nearly 3,000 miles of railroad in China. But what will Europe say?

THE decisions of the courts with regard to the bucket shops are a perpetual see-saw. One of the latest opinions on the subject is that of Judge Collins at Chicago. An injunction had been obtained by a local firm to prevent the Board of Trade from cutting off its quotations. This the Board tried to set aside. The court, while admitting the bad influence of bucket shops, says that the reports are "property affected with the public interest and used in a manner to make them of public consequence," and that the injunction must stand until the final hearing. He considers it the bounden duty of the Board, in fulfilment of its charter, to give the quotations to all who want them and are willing to pay for them. The power to discriminate against certain persons or firms is regarded as dangerous.

ACCORDING to Mr. D. H. Bates, the Western Union Company made a good bargain in its purchase of the Baltimore & Ohio property. He states that the company secured a system capable of handling 12,000,000 messages per annum for a price less than one-quarter the cost to the Western Union Company of the American Union property in 1881, allowing for the difference in mileage and traffic capacity. Mr. Bates contends, and with justice, that the plant is in good shape and represents a substantial and adequate return for the capital put in to establish it. It is possible that in one or two departments there was excessive expenditure, for that is almost inevitable in such a huge business, but taken altogether, the system appears to have been built up with sagacity and carried on with ability. The outlay on the system, $4,000,000, cannot be regarded as excessive, for the work was well done. When we remember that from first to last the system was built up as a legitimate enterprise, and was not started as some oppositions in the past have been, for stock jobbing purposes or simply to be bought off, the pity of its failure seems the greater, and no one need wonder that Mr. Garrett takes it so greatly to heart.

THE substitution of the siphon recorder for the reflecting galvanometer in ocean telegraphy may justly be considered one of the few notable advances in this field, and the method by which it was accomplished reflects the greatest credit upon the skill of its inventor, Sir Wm. Thomson. But the means employed for the vibration of the siphon, consisting in the static electrification of the ink, introduced the only uncertain factor in the operation of the instrument, in so far as it made the instrument dependent, to a certain extent, upon the condition of the atmosphere. It is this factor which a late improvement has finally eliminated, and thus is removed the last cause for delay in cabling, so far as the shore end is concerned. Mr. Cuttriss' beautiful instrument by which the vibrator is maintained in motion by electro-magnetic action, is described in another column, and represents the outcome of a great deal of study. But while these perfections exist there is still a problem to be solved in ocean telegraphy, and that is the devising of a relay for long cables. At the present time signals are successfully relayed over short cables, but thus far we believe no practicable long cable relay has been brought out, so that manual repeating is necessary in many cases. This seems to us the next important thing which merits attention in cable working, and which, we expect, will also soon be arrived at.

THE New York elevated railroads present such a favorable opportunity for applying electricity as a motive power that it is not strange that electricians should devote themselves to the solution of the problem here offered. But, while the conditions at first sight might seem simple, when we come to consider the details, it becomes evident that a perfect *system* demands the exercise of considerable ingenuity. We must, in the first place, consider the heavy and frequent grades to be surmounted with five fully loaded passenger coaches, which must be started under way and stopped in the shortest possible time. And if to this we add the fact that the structure of the elevated roads was designed to carry locomotives capable of hauling only three or four cars, it will be seen that another important factor is introduced in the problem. In other words, the electric locomotive will be required to have increased tractive power without increasing the strain upon the structure. The latest of those who are working upon this problem, Mr. S. D. Field, has just completed a series of tests with a motor of his design embodying a number of new features, and the results thus far obtained are considered so satisfactory by him that he has determined to proceed at once to the construction of a larger motor to fully demonstrate his ideas. In the meantime others who have been at work on the same problem are continuing their labors, so that we may well hope at no distant day to see the elevated railroads operated by electricity. That the project is perfectly feasible no one acquainted with the conditions will deny, and it only remains to devise proper means for carrying it out.

RECOGNIZING the fact that a long time must elapse before conduits can be provided on all streets to be lighted by electricity, and not wishing to check the use of the electric light, the Board of Electrical Control of this city has wisely determined to permit the erection of posts for the stringing of wires and the support of lamps. But a knotty problem has presented itself in the choice between iron and wood for the lamp posts. This might at first sight seem a trivial matter, but upon consideration it was found to be of sufficient moment to necessitate a special hearing of those interested in the subject before the Board. At this hearing, at which all the prominent companies engaged in city lighting were represented, the majority of experts were of the opinion that iron poles introduced an additional element of danger in arc lighting on account of the chance they afforded for the current to be grounded. While it was admitted by some present that an absolute cut-out, which would sever the lamp entirely from the circuit, would diminish the danger to lamp trimmers, it was argued that even with this precaution, unforeseen contingencies, caused especially by damp weather, might make the operation of trimming on an iron pole dangerous. During the audience it came out that the employés of one of the prominent companies, having over a hundred lamp-posts, have strict orders not to mount a pole while the current is on; and as an *argumentum ad hominem* a lamp trimmer was brought forward who related his experience while trimming a lamp on top of an iron post, and who, in spite of two cut-outs, could show one of his thumbs completely burnt off. All of those present who had had practical experience in arc lighting were emphatic in their support of wooden poles, and claimed that while the only advantage of the iron pole is its ornamentality, it embodies so many bad qualities that this one is far outbalanced by the others. Our readers may probably throw some light on this question, and we should be glad to open our columns to a discussion of the subject.

WHILE many electrical engineers long ago made up their minds as to the practicability of street railway cars operated with storage batteries, their successful introduction requires that the men operating street railways be also of the same opinion. It is interesting, therefore, to note that Mr. C. A. Richards, the president of the Metropolitan Railroad in Boston, a gentleman who has given much time to the study of this question, has, according to a recent interview, come to the conclusion that the storage battery car is not only feasible but that it will change entirely the system of conducting the business. Mr. Richards has come to this conclusion after witnessing and testing the electric cars now in operation in Philadelphia and Boston. In describing the ease with which such cars can be handled, he adverts specially to the fact that by means of them rapid transit can be obtained without the building of elevated or underground railroads. He bases his opinion on the experience of the Philadelphia company. In that city the horse cars are able to make only eight round trips per day. On carefully noting the time required to make two round trips, and taking advantage of the time that can be saved in starting, and in the extra speed when opportunity offered to make it, he found that his two trips with the electric car were made in a little more than half the time allowed for horses. This means that with the same number of electric cars nearly twice the number of trips can be made; or the same number of trips now made by horses can be accomplished with about half the number of electric cars. Still another phase of the question brought out by Mr. Richards is the fact that car lines may be extended far out into the suburbs, and still run on the same time as at present. There is one point, however, which Mr. Richards thinks still requires work for its solution, and that is the maintenance of traffic with electric cars when snow and ice cover the tracks. He admits that no great difficulty is experienced on this score on electric roads in other parts of the country operated by electricity, but the peculiar conditions existing in Boston may require unusual methods for keeping the tracks clear. At any rate Mr. Richards is confident of achieving success, and it is probable that the West End car in Boston, which will be run all winter, will settle the doubt absolutely. Railroad men as a rule are conservative, but such expressions of opinion show that the electric motor long since popular with the public is at last obtaining the support of the most prominent street railway managers in America.

Cuttriss' Improved Siphon Recorder for Ocean Cables.

One of the most interesting exhibits at the American Institute Electrical Exhibition is that of the Commercial Cable Company, which has in operation one of the new cable recorders designed by Mr. Charles Cuttriss, the electrician of the company. Visitors constantly surround the apparatus, and many obtain for the first time a knowledge of how a cable message is received.

The great improvement in this instrument over the older forms consists in the adaptation of magnetism in place of static electricity as a means of maintaining the vertical vibration of the siphon. This vibration is necessary in order that there may be no friction between the marking point of the siphon and the paper slip on which the signals are recorded. The instrument is also more easily adjusted than the older forms, all the adjustments being clearly in view of the operator, so that any desired change can be made in the signals without interruption to traffic. The arrangement is such that, if necessary, the signal coil can be removed and replaced in a few seconds without changing or loosening the fibres or disturbing any other part of the instrument; or the magnets can be removed and replaced without disturbance to the signal coil or its attachments.

The paper slip on which the record is written is drawn at a regular speed under the point of the siphon by a small electric motor placed to the left of the recorder at a distance of about two feet from the siphon. By this arrangement the operator does not touch the slip, but reads and transcribes the signals as they pass under his eye, and he is generally writing the same word that the sender at the distant station is transmitting, instead of being three or four words behind, as is the case with the older forms of recorders, owing to the paper being hidden for some length behind wheel-work. This alone effects a great saving of time in the reception of short messages.

The motor has been specially designed to run with six or eight gravity cells, as it has been found that not only are they cheaper to maintain, but they require much less attention than any other kind and are more easily duplicated.

Our engraving shows clearly the functions of the different parts of the apparatus, of which we will first refer to that part of the instrument appertaining to the vibration of the siphon, and which insures a perfect record regardless of the state of the weather or the humidity of the atmosphere.

The siphon *P* is a fine glass tube about one hundredth of an inch in diameter, one end of which writes upon the paper slip *J*, and has attached to its point a piece of No. 30 iron wire about one-eighth of an inch long, which serves as an armature and is controlled by the impulses of the magnetic table *T* over which the paper slip passes. The impulses of the magnetic table are controlled by the vibrator, which is placed on the large permanent magnets *M M*, and consists of a glass tube *W* which is connected by a tube of india rubber to the mercury reservoir *X*. The glass tube is supported by a steel rod carrying a spring contact point *V*, and carries an armature, seen opposite the poles of the small electro magnet *Z*. When a battery of three or four gravity cells is connected to the terminals 1 and 4, the glass tube commences to vibrate at a rate determined by the height of the column of mercury in the glass tube *W*, the height of which can be regulated by turning the milled thumbscrew at the top of the mercury reservoir which connects with a plunger within the latter.

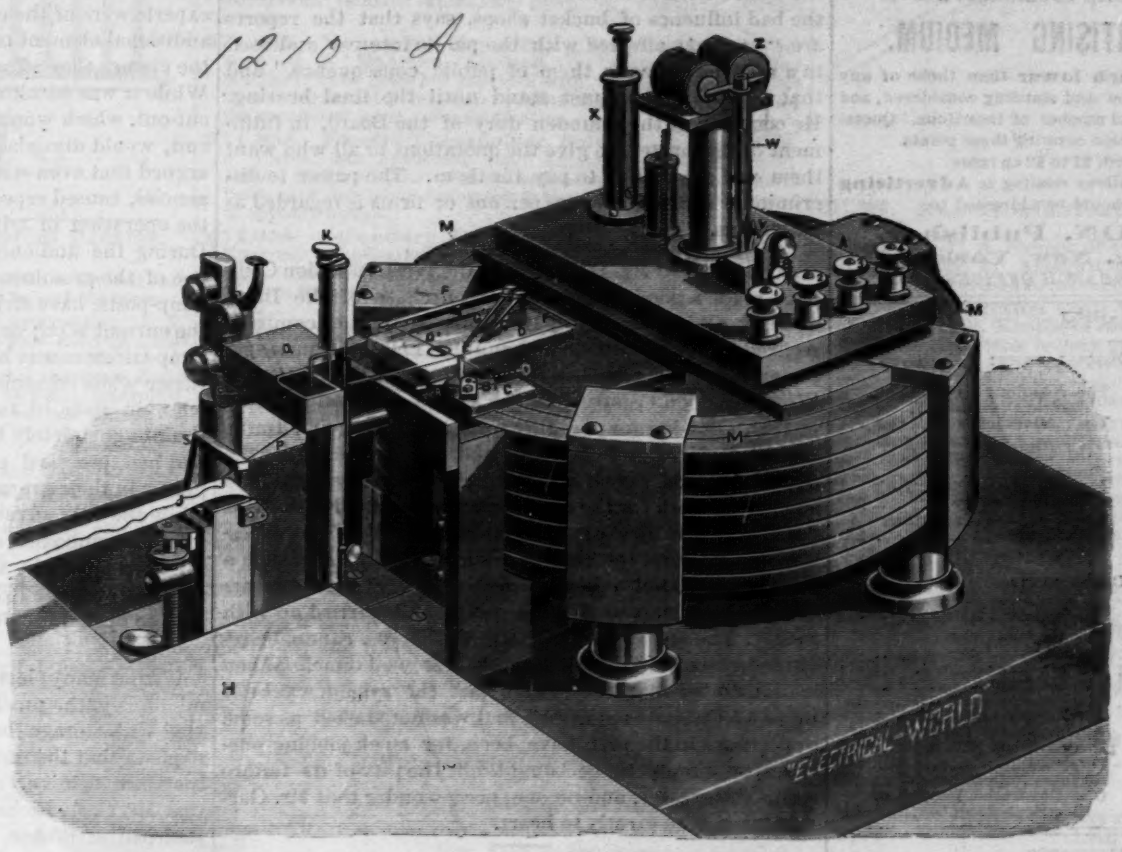
From the terminals 2 and 3 two wires connect to the electro magnet of the magnetic table *T*. Thus every time the contacts at *V* are closed the table is energized and the siphon is drawn down to the face of the paper by the attraction of the magnetic table for the small piece of iron which is attached to the point of the siphon. If the impulses given to the siphon are in accordance with its natural rate of vibration a succession of fine dots of ink will be left on the paper in a perfectly straight line so long as the siphon is not moved laterally by the coil *R* and a supply of ink is maintained in the ink pot *Q*. Should the impulses given to the siphon by the vibrator not be in accordance with the natural rate of vibration of the siphon, it will not vibrate and the record will fail. But by manipulating the plunger in the tube *X*, the height of the column of mercury *W* is varied so that the rate of the impulses can be varied anywhere between 60 and 100 per second. Hence any siphon that would be suitable for the instrument can be controlled, as its rate will lie within these limits. When the proper height of the mercury has been once determined, which is generally found in less than half a minute, the siphon will continue to vibrate until it is broken or removed for other causes.

The signal coil *R*, which is moved by the currents transmitted from the distant station, is pivoted at the bottom and top *B* in agate bearings, and is free to move in the annular space between the poles of the permanent magnet *M*. On the top of the coil there is attached an aluminum extension *E* which has a narrow slot at its upper end through which passes the regulating fibre *D'*, one end of which is attached to a rigid support *O*, the other end being fastened to a flexible spring *F*. The strain on this spring and this fibre is regulated by moving the index *G'*, and the strain thus produced controls the movements of the signal coil *R*. Close to the point *E* and at right angles to the fibre *L'* there is another fibre *D*, one end of which is attached to another exceedingly delicate spring *F*, the other end of which is fastened to an extension from a fine brass wire contained in the tube *L*, to which the siphon is secured. The upper end of this strained wire is attached to the thumbscrew *K*, so that by turning the latter the siphon can be moved laterally over the face of the paper to any required position.

Thus it will be seen that if the siphon is moved off the paper slip toward the front of the instrument when the fibre *D* is strained by moving the spring *F* outwardly, the siphon can be pulled by it into a position over the centre of the paper; the torsion on the strained wire and the strain on the spring now balance each other, and if the two cross fibres are fastened together at a point as near as possible to the extension *E*, any movement of the coil will be multiplied and transmitted by means of the fibre *D* to the siphon. By lifting the fibres out of the slot *E* and turning the coil toward the front of the instrument, the coil and part of the pole piece *C* can be removed from the instrument without disturbing any other part, and, when replaced, no readjustment will be necessary.

This instrument has been worked over one of the Commercial Cable Company's cables at a rate of over 30 words per minute, each signal at that rate being perfectly clear and distinct.

The exhibit of the Commercial Cable Company also includes samples of its cables, deep-sea, shore end, etc., and adjoining these are specimens of sections of cables damaged by ice in Nova Scotia. Several of these, among them a heavily-armored shore end, are crushed out of all resemblance to a cable, and explain graphically why interruption to cable traffic occurs occasionally.



CUTTRISS' SIPHON RECORDER.

The Woonsocket Electric Railway.

The Woonsocket (R. I.) Street Railway Company, encountering as they did the tremendous grades of the hilly region in which their town is situated, decided to adopt a more satisfactory method of propulsion than the customary horse. Negotiations were entered into with the Bentley-Knight Electric Railway Company, and finally arrangements were perfected. Correspondence was entered into with various electric motor constructors, and finally the Thomson-Houston motor was decided upon. Construction was at once commenced both by the street railway company and by the Thomson-Houston Company at Lynn. The road is now in operation.

The generator is of the well-known Thomson-Houston form and of 400 volts potential. This is located at the local electric light station. The car is the ordinary open street car. The motor is the same general shape as the Thomson-Houston stationary motor, but is suspended upon one axle as if lying upon its side. This method of suspension is most ingenious in itself and merits more than a passing notice. The motor is practically pivoted upon one axle with its entire weight upon one side, but extending arms reach over to the other axle, and, catching under a strong spring, counteract the weight of the motor itself. By this method of suspension a portion of the total weight is taken from one axle and is added to the main driving axle upon which the motor is pivoted, thus giving an exceedingly high adhesive capacity, as not only the weight of the motor but a percentage of the car is thrown over on to the driving wheels.

Motion is transmitted from the armature shaft to the driving axle through a countershaft by means of four gears. Although the speed of the armature sometimes runs as high as 1,200 or 1,400, yet owing to the use of raw hide pinions, no noise whatever is caused. Recognizing that one of the most vital details of the street railway motor is in the point of contact between the brushes and the commutator of the armature, the Thomson-Houston Company spent a great deal of most careful and patient research in this direction, and have finally obtained a method which in its simplicity and in its perfection of operation is well worthy of note. Absolutely no sparking is experienced under whatever conditions the motor is subjected to. Reversals are simple and easily made, since only one pair of brushes are used and these are never changed. Another most important point which has received very careful attention has been the simplifying of the devices necessary for the starting, stopping and reversing of the car. Recognizing the value of having as simple a device and as few a number of parts for the driver to operate as possible, the apparatus was finally narrowed down to one handle, and this handle the ordinary brake handle in common use to-day on all cars. The driver has absolutely no other devices to attract or distract his attention. His only duty is to operate the brake handle in one direction for starting the motor, and in the other direction for breaking the current, and at the same time putting the brakes on. It is in brief a combination of the ordinary brake of the car with a simple make and break switch.

On this road the current is obtained from the overhead conductors. These consist of a double line of No. 00 hard drawn copper wires, which are suspended from wires stretching from post to post placed upon the sides of the street. This use of wire as a means of support lessens the liability to the objection sometimes brought up, viz., the unsightliness of the structure for the support of overhead conductors. The current is taken from this wire by a common trolley, which is connected to the car by means of flexible cords and spring clips, so that if it is caught or some accident occurs to it whereby it stops, the spring clips simply pull loose from their fastenings, and no further damage is done. This spring clip is conveniently located just above the driver's head, thus enabling him, if he wishes to change trollies, to enter the car house, or, if necessary, to break the current from the car completely, at any time, by simply pulling the spring clips from their fastenings.

A few words might be said about the road itself. It starts from the centre of the town and runs out for a little over a mile into the suburbs. It has several very sharp curves and one exceptionally long and heavy grade. This grade in its steepest portion is somewhat over 7 per cent. Frequently up this grade the car has been stopped, and, in fact, has been run off the track and then run back on to the track, and going up hill too. This test in itself is a sufficiently trying one to demonstrate thoroughly the capabilities of the motor and system, and yet absolutely no sparking was observable.

Communication between Russia and France.—It is announced that steps are being taken to establish additional telegraphic communication between Russia and France. At the present moment the only method of communication is via Germany, and it is asserted that the dispatches are frequently tampered with at Berlin. In the case of a war with Germany and Austria the matter would become still more serious, for Russia would then be entirely cut off from telegraphic communication with France and the remainder of Europe.

The Field Electric Locomotive.

For several months past Mr. Stephen D. Field has been engaged in the completion of an electric locomotive designed for use on the elevated railroads of this city, and within the last few weeks it has been in operation on the Thirty-fourth street branch of the New York Elevated Railroad. We have already given an account* of the details of construction of the motor, but it may not be uninteresting to recall the salient features as they appear embodied in the finished machine. The locomotive as it stands upon the track is shown in the accompanying engraving, Fig. 1. The motor is mounted upon the rear truck, and the distinguishing feature is its mode of connection with the drivers. The arrangement, as will be seen, is exactly similar to that employed in the ordinary steam locomotive, and consists in the direct connection of the motor shaft with the drivers by means of a crank and side bar. The great advantage of this arrangement in the electric locomotive over the steam locomotive is apparent when we consider that in the latter the maximum effort is exerted on the drivers when the cranks stand vertically either above or below the centre, and when on the centres no effort whatever is exerted. In the electric locomotive, however, the armature exerts a uniform and continuous effort upon the side bar which is transmitted directly to the drivers, no matter what the position of the cranks may be. It follows from this that the starting up is much quicker than in the case of the steam locomotive, where the power of only one cylinder is available at a time.

The motor, which is series wound, is regulated by means of a liquid rheostat placed in the cab of the locomotive, shown in Fig. 2. This rheostat consists of a trough divided into two compartments filled with acidulated water. A metal plate on either side of these troughs acts as a terminal for the circuit, which is led in by the two cables shown. The speed of the motor is regulated by inserting or withdrawing from the troughs two slabs of slate, which are suspended over the troughs and can be raised or lowered by means of the long lever traveling over the sector shown at the right in the cab. By means of this liquid rheostat the resistance can be graduated from practically nothing, *i. e.*, when the slabs are fully drawn up, to an infinite resistance when completely lowered into the troughs. On the standard which guides the slabs there will be seen a spring clip, and on the right hand slab a plug. This is so arranged that when the slabs are full up the plug presses between the spring clips and cuts out the rheostat entirely. The reversing switch, for reversing the direction of the motor, is shown in the lower right-hand corner of the cab.

In designing the locomotive Mr. Field constructed special brush shifting apparatus for preventing sparking at the commutator with change of speed and load. This consisted of a small motor which shifted the brushes in accordance with the action of a relay in circuit with the terminals of two auxiliary brushes placed at the neutral points on the commutator. Actual practice, however, has shown that this refinement of brush regulation was unnecessary, the brush lead under the influence of the peculiar speed regulation employed having been found to remain fixed and at an angle of 45 degrees; this, no doubt, being due to the large mass of iron employed in the construction of the field and armature.

The following table gives the weight and dimensions of the locomotive:

Weight of motor	9 tons.
" " armature	1 ton.
" " wire on armature	600 lbs. No. 7
" " " " field magnets	1,600 lbs. No. 4
Total weight of motor, car and forward truck.	18 tons.
Diameter of drivers	3 feet
" " armature	2 feet.
Length of armature	42 inches.
Wheel base	5 feet.

The track on which the motor was operated is on one of the steepest grades in the city, on which account it was peculiarly well adapted to show up any weakness in the system employed. One passenger car forms a load for a 13-ton steam locomotive regularly employed.

The motor easily drew one of the regular coaches up this grade at a speed of about 8 miles per hour with a current expenditure of 35 ampères under an E. F. M. of 800 volts. The loss in conversion was found to be very small.

Various potentials were at times employed, 1100 volts being used at one time with the same freedom from sparking as with the lower potential; the only change noticed being an increased speed of the motor.

The generating plant was situated at a distance of half a mile from the track and consisted of a single dynamo, built by Mr. Rudolph Eickemeyer, of Yonkers, in whose shops, also, the locomotive was built. This generator is of the iron-clad type, and showed itself fully capable of handling the load placed upon it.

The tests made, which extended over several weeks, have so thoroughly convinced Mr. Field of the practicability of the new ideas embodied in this motor that he is now preparing to demonstrate with apparatus on a large scale the practicability of electricity as a motive power for the elevated railways of this city. Among the other novelties embodied in the motor is the "pick up" wheel of Mr. Field, which operates admirably, so that no sparking whatever can be observed.

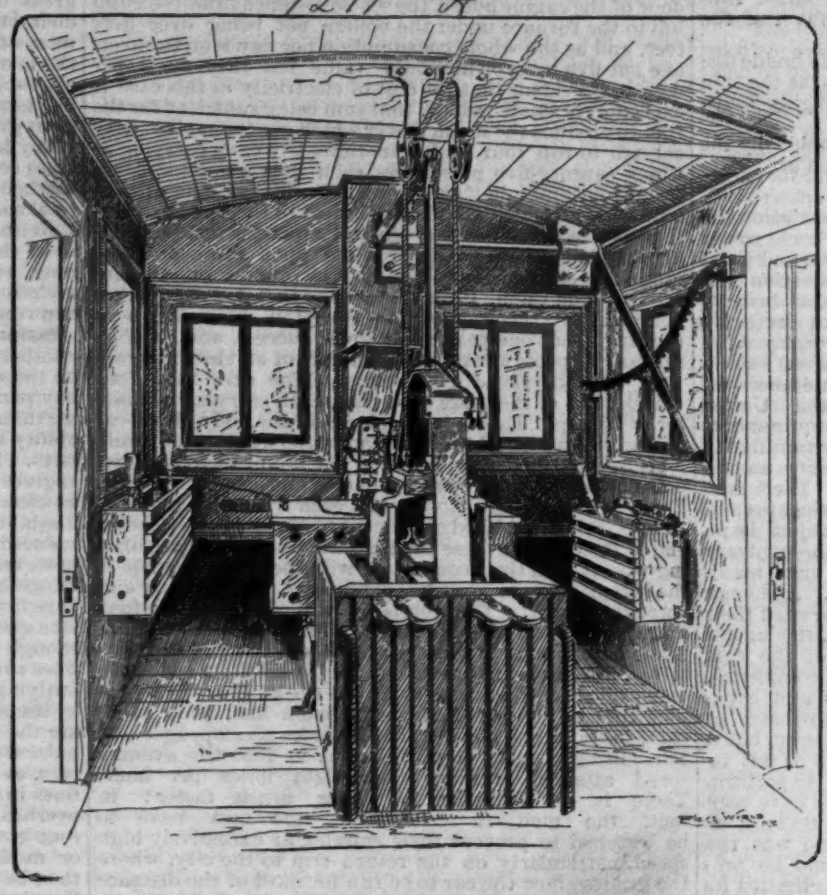


FIG. 2.—FIELD'S ELECTRIC LOCOMOTIVE—INTERIOR OF CAB.

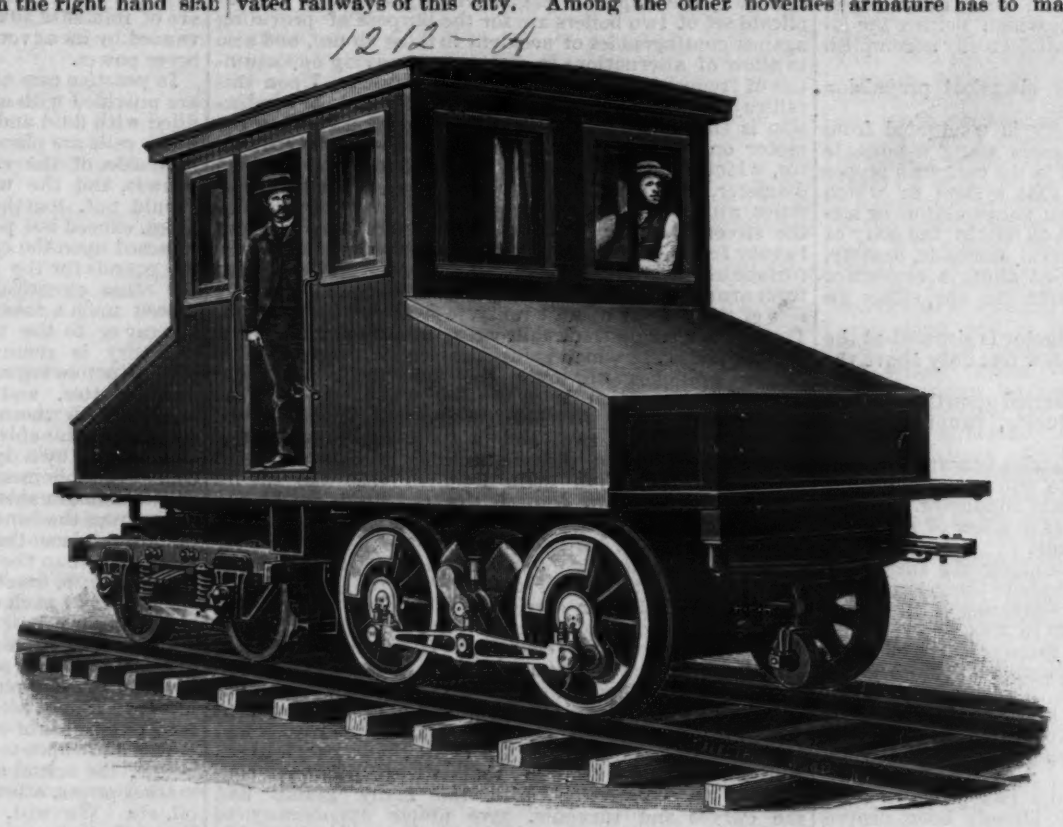


FIG. 1.—FIELD'S ELECTRIC LOCOMOTIVE—PERSPECTIVE.

* THE ELECTRICAL WORLD, Nov. 6, 1886.

Spur Gearing for Electric Street Cars.

To the Editor of The Electrical World:

SIR: At a meeting of the American Institute of Electrical Engineers, held Sept. 20, Mr. Anthony Reckenzaun, in an address on the subject of "Electric Street Cars, with Special Reference to Methods of Gearing," referred to the experiments which are going on at Mr. William Wharton, Jr.'s, establishment in Philadelphia, and makes the following statement:

"There we used a set of spur-gearing, which was supplied by the Sprague Company. In this case the motor shaft, which runs at from 500 to 600 revolutions a minute, carries two steel pinions, one at each end of the shaft, and these pinions gear direct into two cast-iron spur-wheels upon the driving axle without any intermediate wheels. The motor is partly suspended on the axle and partly on the body of the car. We have run several hundred miles with this car under all conditions of load, gradients and weather, on some of the roughest tracks in Philadelphia, but up to this moment not a single hitch has occurred. The gear is perfectly noiseless, it is efficient and strong, and I see comparatively little indication of wear. The teeth are beautifully shaped, therefore somewhat expensive; but if they last long enough and if they do not rattle when partially worn, this expense can be ignored. This car contains, besides its usual weight, about 3,200 pounds of storage batteries. It has to mount grades of 5 per cent. and run on curves of 35 and 25 feet radius, which means very hard work."

I wish to correct an impression which one would gather from these remarks of Mr. Reckenzaun, and which hardly do justice to the method of mounting which is there used. The suggestion that the gears are necessarily expensive because of the beautiful shape of the teeth is incorrect; the shape of the teeth has absolutely nothing whatever to do with the expense of the gears as we make them, for they are no more expensive than any other form of tooth in cut-gears.

There are several reasons other than the shape which make these gears so noiseless. The motor, in the first place, is hung upon the driving axle at two widely-distant points, and is supported in the centre of the other side by a double-compression spring. In this manner absolute parallelism is maintained between the driving and the driven axle in all planes, no matter what the movement of the axle. There is no twisting or tendency to twist on the face of the gears and pinions; the thrust at all times is absolutely in the plane of the gears and pinions, and these are always parallel. The bearings of the armature are very close to the pinions, so that there is no spring whatever in this shaft. One pinion is set about half a tooth ahead of the other. One of the main gears is fixed; the other is adjustable, so that there is no interference in the thrust of the pinions, and a much more perfect simultaneous meshing of the gear is obtained than would be possible where dependence upon the cutting of the splines is necessary for the adjustment.

From two to three teeth on each pinion are always engaged. The proportions of the pinions are such that the armature has to make as many revolutions as there are teeth in the large gear before the same teeth in the gears and pinions engage with each other, and, finally, by reason of the method of supporting, there is always a spring touch, so to speak, of the pinions upon the gears. No matter how sudden a strain is brought upon the motor, it always yields more or less in a direction concentric to the axle of the car, so as to relieve the teeth from all shock. The wear of the gears must be absolutely the same. It is simply impossible for rattling to take place on these gears even if they were worn down one-half of their present thickness, and this wear, where the gears are properly protected by screens, will be very light.

The method of mounting and the general plan of using these gears has far more to do with their noiselessness and efficient operation than the shape of the teeth, although this shape, being of the involute character, is such that they will mesh perfectly even where there is some change in the distance between the centres of the axles. If it were not for the method of mounting it would be impossible to run this kind of gearing, as has been frequently done, with variable strains at a speed as high as twelve hundred feet per minute. At no time, under the severest strains it is possible to put on gears of this character, have they ever shown any signs of weakness or undue wear, and in comparison with fixed gear this method of mounting must necessarily be the more satisfactory.

F. J. SPRAGUE.

NEW YORK.

Once More Unto the Breach.—A Wall street paper says it is a fact that a syndicate has been formed to establish a new telegraphic system which will embrace all the principal cities as far west as the Mississippi River. It is composed of people having ample capital for the purpose as well as the intention to carry out what they have undertaken.

The Philadelphia Street Railway Convention.

The sixth regular annual meeting of the American Street Railway Association was held at Philadelphia on Oct. 19, 20 and 21 at the Continental Hotel, under the presidency of Mr. T. W. Ackley. The attendance was very good, and a noticeable feature was the active participation of a number of gentlemen connected with electrical applications, including E. V. Cherry, F. J. Sprague, H. McL Harding, A. K. Stiles, C. J. Van Depoele, G. W. Mansfield, C. E. Stump, A. Reckenzaun, R. W. Blackwell, T. C. Martin, E. E. Ries, A. H. Henderson, E. H. Hastings, A. H. Chadbourne, G. H. Condict, H. A. Foster, J. M. Pendleton, E. J. Bagnall, W. H. Knight; to whom may be added Wm. Wharton, Jr., and Calvin A. Richards, both of whom enjoy high repute in street railway circles, and have pronounced views in favor of the use of electricity for urban passenger traffic.

It may be said that the convention did little beside discussing electricity in its relation to street cars, as the subject came up at every session and was thoroughly ventilated in all its many and different aspects.

The first morning, Oct. 19, was largely occupied by the reading of the subjoined paper by Mr. Wharton on

ELECTRICITY AS A MOTIVE POWER.

Since the last annual meeting of this association the subject of using electricity as a substitute for horse power on street railways has received much attention, and great advances have been made in the practical application of it to that purpose, so that it may now be stated broadly there is no longer any doubt or uncertainty that electricity can be successfully and economically employed in a great many places, if not most places, as a substitute for animal power. Quite a number of electric railways are in operation in the United States, running satisfactorily under all the requirements of public service, so that there is much greater familiarity with and a more general knowledge of electricity among railroad men and the public than ever before. There is so much confidence in the practicability of electrical propulsion of cars being well established, that the subject is no longer treated with doubt or disdain; on the contrary great interest and respectful attention are at once manifested whenever the subject is brought up. Although some parties, interested perhaps in pushing forward their own special inventions, may claim too much, the actual facts as presented daily in the regular work of the cars are good enough to warrant this belief and confidence. Electricity in its manifestations, applications and capabilities, has been hitherto a subject, the knowledge of which has been confined mainly to scientific circles, but it is evident that the time has come when it will be put in harness in place of the horse to draw cars and to perform many other duties, which a few years ago would have been considered entirely chimerical and visionary. So long as the oxidation of metals or other chemical action was the only available method by which electricity could be produced, the expense attendant upon such means limited its use to a very narrow sphere. Since, however, steam power and water power have been so successfully employed to generate electricity, and to do it so cheaply, the range of its usefulness and application has been wonderfully enlarged from year to year. It is not intended in this paper to make use of scientific terms, or to discuss the question from any standpoint but that of practical observation and experience; nor is it intended that any comparisons shall be drawn between electric motors and steam locomotives, but there is a wide field for work in which neither the locomotive nor the horse is able to satisfactorily accomplish the duty called for.

The systems at present in use for electrical propulsion of cars are divided into two classes.

First, that in which the electricity is conducted from one or more active generating sources along a suitable conductor or conductors to be used in the cars with proper return connections; and secondly, that system in which the electrical power is obtained from accumulators or secondary batteries carried along with or within the body of the car. Of the first there are several methods, namely, that in which the electricity is carried along a conductor above the ground, considerably above the car, either directly over it or toward one side.

That in which the electrical conductor is situated at the side of the railroad and elevated a few feet only above the ground.

That in which the electricity is carried upon the surface, either by a third rail or other conductor, running on the level of the ground or pavement.

That in which the electricity is carried beneath the surface by a conductor placed within a suitable conduit for its protection, access being had to said conductor through a slot in the top of the conduit, so as to allow of electrical connection with the motor on the car.

The plans of having the conductor along the surface or at the side of the railroad not much above the surface have so many evident and practical disadvantages that they need not be taken into consideration in this paper; therefore the question is reduced to the three methods of overhead conduction, underground conduction and storage batteries.

It is evident that better service must be furnished at the same cost, the same service furnished at a cheaper rate, or that both objects combined shall be attained by the use of electricity before it takes the place claimed for it. The writer believes fully that the last proposition of both better and cheaper service has already been proved by actual service and daily use, but in the nature of things, improvements upon the present methods will be discovered, and "the survival of the fittest," which applies as well to mechanical appliances as to animated life, will by its inexorable laws weed out and discard those which are deficient or incompetent. There are so many intelligent, persevering and scientific minds engaged in active experiments and researches into the mysteries of Nature's powers, and more especially those relating to electricity, that discoveries are constantly being made, human knowledge in this age extending more rapidly than at any previous time. The subject is fascinating and the prizes sought after are brilliant and valuable. The increased cheapness in production of electricity which may fairly be assumed for the future, will of course add to the advantages, and enlarge the scope, of its use. At present there are many places where electricity can be generated at a nominal cost by the use of water power, and this energy can be carried a number of miles without any loss or leakage of practical consequence. Where this can be done of course the parties have special advantages. So also there are many towns and cities in coal regions, or natural gas regions, where the same result of cheapness in production can be obtained, although by different means. As a case in point it may be mentioned that the electrical railway in Scranton, Pa., has its power station located about midway of the route, and immediately at the foot of a large hill or great mass of hundreds of thousands of tons of culm, which is principally composed of the small fine particles of coal produced in mining or left after the screening and preparation of the commercial sizes of coal for the market. This has been accumulating for many years, is still accumulating, and has hitherto been considered only an inevitable nuisance, which the mining proprietors would gladly have given away for nothing to get rid of it, and not have it occupy their land. The price which the railroad company pays for this culm is but ten cents per ton, and as it only has to be wheeled through the door of the engine house, the whole distance from the culm hill to the furnace under the boilers not being over fifty feet, and as the whole consumption per day is on the average but five tons, or in money value but fifty cents per day, it is evident that the cost of electricity in this case is exceedingly small indeed, that sum being sufficient for the fuel to produce the steam power which generates electricity enough to run four and sometimes five cars, carrying at times seventy-five passengers each over a railroad track about four and a half miles in length, having long grades, a number of which are five or six feet to the hundred, and the steepest of which is seven and a quarter feet per hundred. The tractive power required upon some of these grades is still further increased by curves or switches occurring on them. It may be well to mention some other points about this railroad in Scranton, which has been running about one year, with great success, and exhibits in many respects a favorable example of an electrical railway with overhead conductors. The cars have four wheels; two of them are open cars, each carrying one motor of 20 h. p. The motor is placed in the body of the car midway of its length, and all four of the wheels are driving wheels, the connections between the motor and the wheel axles being made by means of chains and sprocket wheels. Three of the cars are closed cars, each with one motor of 15 h. p., which is placed on a closed platform at the forward end of the car. In these the forward wheels only are driving wheels, and their connection with the motor is made in the same way as on the open cars, with chains and sprocket wheels. The company will shortly place four more cars upon the line, each with a motor of 25 h. p. These larger cars are intended not only to propel themselves, but to be able each to haul in addition two other cars loaded with passengers up all the grades. The running time of the round trip on the main line, being in all eight miles, is one hour, which includes all stoppages and the waiting at each end of the route, so that the average speed attained is more than eight miles per hour. There is no difficulty in going much faster: in fact, the men in control of the cars have to be watched to prevent their running at excessively high speed, particularly on the return trip to the city, where the grades allow the car to be run for most of the distance by gravity alone. At the generating station there are two stationary engines of 180 h. p. each, two dynamos of 100 h. p. each, and four boilers of 100 h. p. each. Only one engine and dynamo, however, and two of the boilers are in use at any one time. The railway company expects also to furnish in the future electricity for the lighting of the town of Dunmore, situated at one end of the line, by which the income of the company will be materially increased. The duplicate engine and dynamo and the duplicate set of two boilers are for the purpose of providing against contingencies of accident to those in use, and also to allow of alternations in service, thus giving opportunities of frequent examination and inspection. Upon this railway, as before stated, the overhead system of conduction is employed, having flexible connection between the motor on the car and the carrier traversing the conductor, which is a solid copper wire of five-sixteenths inch diameter, suspended on a part of the route from tranverse wires attached to wooden poles placed on both sides of the street about one hundred feet apart lineally, about twenty feet high and about six inches in diameter at the surface of the ground, and on the rest of the line suspended from arms projecting sideways from wooden poles at the side of the railway about twenty feet above the ground. The line is a single track railroad with several turnouts or passing places, at which points the electric overhead conductor branches off over the side track also, and an ingenious system is in use by which the carrier, running upon the overhead wire, with two grooved wheels of about two and a half inches diameter, automatically shifts the connections at the points of divergence from the main line, so that the carrier always follows that one of the overhead conductors which is above the track upon which the car is traveling. It is contemplated, however, to use two separate and independent overhead conducting wires throughout the whole length of the route, so as to avoid the possibility of any difficulty with the carriers at the points of intersection at the turnouts, although this has not happened often. The return current of electricity is taken by the rails. The electrical current has a tension of about six hundred volts, which while sufficient to give a shock, could not produce any dangerous effect on man in case the current should by any means be diverted. Part of the road is laid with tram rails and the rest with T-rails, and a part is paved and the rest unpaved, so that these different conditions, in connection with the many grades and the curves and turnouts, give ample opportunity to thoroughly test the working of the system. Although the overhead wires in this case do not present any more unsightly appearance than the numerous telegraph cables and wires to which we are so accustomed, it is, however, evident that the use of the overhead system will be prohibited in most cities and towns, especially since the general determination to place all electrical wires through cities underground. The noise of the carriers running on the conductors is not much, although it can be readily noticed, but the noise produced by the motors and the chain and sprocket connections is quite considerable. This latter could be entirely avoided by the use of a noiseless motor and a better method of connection, of which motors and connections there are several kinds easily obtainable. Noiseless, efficient and durable electric motors suitable for use on cars can be had in which the weight per horse-power does not exceed sixty pounds.

In a paper of the length to which this must necessarily be limited, it will be impossible to do much more than treat of the subject in a general manner, but it can be stated specifically and certainly that electric railways with overhead conduction have demonstrated beyond a doubt their capability to propel a few cars, even if heavily loaded, at less cost and much greater speed than could be obtainable on railways operated by horse power. This is true in places where the coal required must be bought at usual rates and the exceptional advantage of fuel at merely nominal cost does not exist as at Scranton, and likewise at Wilkesbarre, where an electrical railway is under construction, upon which the cost of coal used will not exceed sixty or seventy cents per day for five cars.

In the case of electrical railways with underground conduction the effort has been made to give all the advantages of the overhead system, and at the same time remove the objection which in most places is absolutely prohibitive of having the conductors and poles or other supports obstructing the streets. In doing this, however, great difficulties arise, some of them of a very serious character. The costly conduit, with the needful arrangements for drainage and for cleaning out, together with the increased care necessary to provide against the considerable loss or leakage of electricity, which nevertheless generally takes place in spite of all precautions, detract greatly from the apparent advantages of the plan. Many inventions have been patented and numberless devices contrived to overcome the many objections of this method, but there is great room for doubt whether practical success has yet been obtained.

Neither by overhead nor underground conduction have more than a few cars as yet been moved simultaneously upon railways, although many ingenious arrangements are offered by various parties who confidently assert they can run any required number of cars. This, however, yet remains to be proved. Both plans, also, are open to another serious objection in the entire stoppage of travel on the whole line in case of breakage or derangement of any part of the conducting apparatus or the generating machinery. In this respect they are under the same disability that the cable system of car traction is hampered with. Possibly, by suitable arrangements of duplicate engines, boilers and dynamos, duplicate conductors, and auxiliary, sectional, or relay systems of conduction, this disability, threatening as it appears to be, may be so reduced as to be of no great detriment. This, however, also remains to be demonstrated. Taken altogether, underground conduction does not compare favorably with overhead conduction up to this time. One great trouble with the latter plan, however, is that although it can be used to great advantage and economy on lines running a few cars in towns, or in suburban districts outlying large cities, it will probably never be allowed by the municipal authorities in large cities, which of course are the very places where the advantages of electrical propulsion are needed the most. To move a large number of cars, as for instance upon the Third avenue or Broadway lines in New York city, the electrical conductor, whether overhead or underground, must be of great size if the current is of low tension; while on the other hand, if a small or moderate sized conductor be used, the current must then be of dangerously high tension, and of course it would then be very difficult to avoid great loss of electricity from leakage.

There remains to be considered the accumulator or secondary battery system. In this each car carries its own supply of energy, and is entirely independent of any method of continuous electrical conduction. No change of track or roadway is required, nor any costly conduit or unsightly poles or other supports, while the cars can run anywhere that a car can be taken by horses. These points are of immense advantage, and are the chief merits advanced by its advocates, independent of its economy over horse power.

In practice cars of the size of the usual two horse cars are provided with about 80 accumulators, weighing when filled with fluid and ready for use about 40 pounds each. These cells are placed under the seats, one half being on each side of the car. Their combined weight is 3,200 pounds, and the weight of two motors each of 5 h. p. should not, together with their connections to the car axles, exceed 800 pounds, so that the additional weight imposed upon the car is, say 4,200 pounds, which allows 200 pounds for the apparatus to control the current and for other electrical appliances. This added weight if placed upon a four-wheel car may be of disadvantage to the car or to the track. If this should be the case, the difficulty is removed by the use of eight wheels on two swinging trucks, which support the car much better, and distribute the weight upon the track. Both these kinds of storage battery cars are in service with entire success. The charging of the cells is done by a dynamo driven by steam power or any other desirable means, and it takes four hours to charge cells which are able to perform four hours work. To remove from the car the cells which have done their work and to replace them by freshly-charged cells takes no more time than the time required to change horses. It requires 10 h. p. exerted for four hours to charge the batteries or cells of each car, so that 40 h. p. hours are needed to accomplish it.

The cost of running large stationary steam engines of, say, 200 to 400 h. p., constructed with the modern improved cut-off appliances and other economical devices, has been found, after extensive investigations, not to exceed two-thirds of one cent per horse-power hour.

This allowance is a liberal one, and is above, rather than below, the actual average cost, including fuel at average market prices, attendance, repairs to engine and boilers, oil, etc. We will, however, take it at 1 cent per h. p. hour: Forty h. p. hours at 1 cent costs 40 cents, which is the cost of 4 hours' car service, and as the day's work of a car should be taken as 16 hours, we have as the whole cost of a day's supply of electricity four times 40 cents, or $1.60. Since four teams of two horses are required to draw a car for 16 hours, and as one additional horse per car is the usual allowance for sick or disabled horses, nine horses per car are needed for a day's work, which, at 50 cents per horse for feed, bedding, attendance, shoeing, etc., is $4.50, against $1.60 for the storage battery electricity. Making extraordinary allowance for possible errors in this comparison, the difference is still astonishing to those who have not looked into the matter critically. With motors properly constructed a speed of eight or nine miles per hour is readily accomplished—in fact, eight miles per hour may be taken as the speed at which such motors will work to the best advantage, and return the greatest percentage of mechanical efficiency. The requirements of street-car service demand variable rates of speed, as for instance in crowded streets, behind other vehicles, or in turning curves and entering switches it is necessary to go slowly and cautiously; and the weight of the load carried at dif-

ferent times will vary from an almost empty car to one overloaded. These conditions, together with increased power needed to ascend grades and to start loaded cars, especially on up grades, call for electric motors which will under such greatly varying circumstances respond at all times almost equally well.

There are motors which while engaged in performing an equable work and running at an equable speed, for both of which purposes the motor was specially made, will return 90 or possibly 95 per cent. of efficiency, while the same motor when run at some different speed or under some different load may return but 30 or 35 per cent. So that the average performance of such motors in street car service would probably give only 50 per cent. return of efficiency. Motors can, however, be obtained which will under all the variations of street car work constantly return 75 per cent. of efficiency.

The durability of storage batteries is a point which those interested in other systems are very prone to doubt, but it has been proved in actual use in cars that they will continue in good serviceable condition for eighteen months or two years. Makers of these batteries offer to guarantee them good for two years of street car service. The lead-lined wooden containing boxes will last for many years; the negative plates are good for more than two years, while the positive plates are certainly good for eighteen months, if not more.

The plates being of lead and lead oxide are still of value when they become unserviceable, for the metal can be recast into new plates, and the lead can be recovered from the oxide. The first cost of storage battery cars and the engine and dynamos is at present prices considerably more than the first cost of cars provided with suitable complement of horses and harness, but when the saving in first cost obtained by dispensing with the ground and the stables required for horses is taken into account, the balance will in many cases be in favor of storage battery cars. This is of course applicable more particularly to large cities where ground is very valuable. By methods now being introduced into the manufacture of storage batteries, their production will shortly be made at a reduced cost, and their durability increased at the same time.

It should be remembered that the increased speed at which electric cars can travel is so much greater than horses could draw them, that two cars can readily do the work of three horse cars, especially as the electric cars require no time for resting at the ends of the route; but although they can easily do this, so much increase of speed would not be allowed or be practicable through the streets of most cities or towns. It could be done with safety and advantage through wide streets or avenues and in suburban districts. It will, however, be perfectly safe to say that three electric cars can do the work of four horse cars, and, if desired, they can at the same time be of greater capacity than horse cars, for while the horses can do no more no such difficulty exists with electricity. Without referring to the excessive first cost required for the expensive cable traction system, and comparing the first cost of the entire plant and equipment needed for a storage battery electric railway on which three cars will perform the service of four horse cars, with the first cost of the entire plant and equipment of a railway using horse power, it will be found that the advantage will in most cases be in favor of storage electricity. Let us now compare the operating expenses.

Running expenses of 4 two-horse cars for one year, to wit:

Conductors, 365 days, at $3.00 each car per day of 16 hours...	$4,380
Drivers, " " $2.50 " " " " " ...	3,650
36 horses, " " .50 " per day.....	6,570
	$14,600
One year's deterioration and repair of 4 cars at $200 each.....	800
" " " of 36 horses, at $40 each.....	1,440
	$16,840

Running expenses of 3 storage battery cars for one year, to wit:

Conductors, 365 days, at $3.00 each car per day of 16 hours	$3,285 00
Drivers, " " $2.50 " " " " "	2,737 50
Electricity, " " $2.00 " " " " "	2,190.00
	$8,212.50
One year's deterioration and repair of 3 cars, including dynamos, storage batteries and motors, $1,600 each.....	4,800 00
	$13,012.50

This leaves a balance to the credit of the storage battery cars of $3,827 50.

The fact of each storage battery car carrying within itself its own energy gives to the individual cars an independence of action which neither the cable traction plan nor the overhead or underground system of electrical propulsion possesses, for all of these depend upon central sources of power, which may at any time be interrupted, so that breakage or accident to any part involves the stoppage of the whole line.

In a sanitary and cleanly point of view the withdrawal of the car horses from our streets would be of great benefit, and this would be accomplished without having, as in the case of the cable railway, an open drain, which, although supposed to be kept clean, in fact nearly always contains a deposit of street refuse to a greater or less extent.

The leakage of electricity in storage batteries, charged but not in use, need not be taken into account for any length of time that cars would probably stand idle. In fact, the leakage from batteries in good condition would not exceed ten per cent. in three months.

The percentage of mechanical energy given by the steam engine which is recovered in actual work under the variable conditions of street car service on the driving axles, with storage battery cars properly equipped, is at least forty per cent., and with electricity by direct conduction at least fifty per cent. In cable traction, after deducting the power needed to move the cable and to revolve the wheels guiding and carrying the cable, not over twenty-five per cent. is left for drawing the cars, and on some cable railways even less.

The increased speed so easily and advantageously obtained on electric railways as a class, not only enables three cars to do the work of at least four horse cars, and effect the great annual saving shown above, but it has a tendency to invite travel and thereby increase receipts, also to give street railways the opportunity to extend their lines advantageously further into outlying districts and to compete on better terms with elevated roads and steam railroads than would be possible with horse power.

The rapid deterioration and destruction of street car horses shows the exacting and terrible nature of their work, although it is for only four hours per day. Their powers are already overtaxed, and they can do nothing more either in speed or in load carried.

Electric cars, by dispensing with horses, allow more room in the streets for other vehicles, and this advantage in crowded streets is of moment. Take, for instance, Washington street, Boston, or Broadway, New York, and it will be readily seen that this relief to the clogged traffic would be great.

Electric cars can go backward or forward with equal facility, they are under perfect control, can stop and start more quickly than horse cars, and in case of delay can make up lost time. They never get sick with epizooty or other disease, and during strikes or other periods of enforced idleness do not require to be fed. On down grades they will run by gravity without the expenditure of other force, and on level or nearly level stretches a very little electric energy continues their motion when once they are started.

The electricity, beside running the motors, will supply the car with incandescent electric lights, actuate an electric signal gong and operate electric bells for the use of the conductor and passengers in stopping or starting the car. It is usual to have the regular hand brake for stopping the cars, but the motors can be instantly reversed by electricity if desired. This method, however, should only be employed when it is necessary to stop the car very quickly to avoid accident or for some other imperative reason. By this means the car can be stopped in much less distance than is possible by the hand brake, which, of course, operates with the same efficiency whether upon electric cars or horse cars.

It has been questioned whether in winter, when the tracks are liable to be obstructed with snow or ice, the electric cars will be able to propel themselves, owing to the fact that they obtain their power of propulsion from the adhesion of the wheels upon the rails, so that if the wheels are prevented from reaching the track there would be a great liability of their slipping and turning around without giving any forward motion to the car itself. In answer to this, it may be stated that during last winter on the electric railway in Scranton, having the overhead conduction system, and from experiments made in Philadelphia with a storage battery car, it was found that there was no unusual difficulty presented in snow-storms, the wheels, owing to the added weight, settling more readily through the snow, and thus reaching the rails. Upon roads properly equipped with snow plows, or snow sweepers with revolving brushes, propelled by powerful electric motors, the clearing of snow from the tracks would no doubt be much more efficient than horse-power could effect. Street car electric motors of 50 h. p. or more, if required, can be as easily made, and are as easily controlled, as motors of 5 or 10 h. p., so that electricity has ample ability to keep the tracks clear from accumulations of snow. As with locomotives, sand-boxes should be placed upon electric cars, so that if any slipping of the wheels should be observed, either from the greasy, slippery condition of the track, sometimes seen in damp weather when the streets are not properly cleaned, or from snow or ice upon the track, the driver, by opening a suitable valve, can let out a little sand upon the rail, and at once overcome the difficulty.

It is sometimes asked why two motors of 5 h. p. each should be needed upon a car usually drawn by two horses. In explanation of this it may be stated that a car horse can, and very often does, exert for a short time in starting a car or upon steep grades a force of five or even more horse-power. A mechanical horse-power is the measure of the moderate duty which a horse can constantly and regularly exert day after day in a regular day's work without injury; but car horses are constantly temporarily called upon to exert unusual and unreasonable power, which is the reason they are so rapidly destroyed in street car service. It is evident therefore that the electric motors must be able, when called upon, to exert the same power that the horses under pressure can be made to perform temporarily, so that a maximum of 5 h. p. in each of the two motors will develop only such force as the requirements of street car service are constantly demanding during short periods of time.

It is not intended in this report to indicate that cable railways for use on steep hills or high grades will be superseded by electric railways, for the latter are limited to such grades as the adhesion of their wheels upon the rails will enable them to surmount, just as in the case of the steam locomotive, so that there is a suitable and proper sphere of usefulness for cable railways in the many places for which they are particularly adapted.

It has been proposed to increase the tractive power of electric cars upon inclines by causing magnetic attraction to be developed between the wheels and the rails, and also by the use of other devices. All these methods present complications which probably will more than outweigh the advantages sought to be attained.

In developing the best construction and management of electric cars and railways, careful attention to details, some of which at first sight may appear trivial, should be exercised, in order to obtain the best results, no matter which of the three plans be adopted. It should, however, be said that in practice at the present time the running of electric cars requires no more intelligence or skill than the running of horse cars, and also that the electric current with continuous conduction on lines using a few cars, need not be of such tension as to endanger human life, 500 volts being sufficient. With the storage battery system the tension of the current is so low, 160 volts being sufficient, that no shock whatever could be experienced by a man taking through his body the whole current required to propel the car. This has been repeatedly done, some of the people stating they felt nothing at all, and the others no more than a slight tingling sensation.

The term "storage batteries" so generally in use, is apt to give a wrong impression, no electricity whatever being stored or contained within them, for in charging the batteries a chemical action is forced to take place, and when this chemical action is allowed to reverse itself electricity is generated thereby. The car motor immediately uses this, and when the motor is stopped the chemical action and, therefore, the generation of electricity ceases.

In this report care has been taken not to refer by name to any patented inventions, or to recommend any particular make of electrical appliances. As to these matters, those proposing to use electricity, whether by overhead or underground conduction or by storage batteries, should of course be careful to select such methods as are the most reliable, efficient and durable, and to deal with parties not only responsible as to the validity of their patents, but capable of doing what they undertake to perform.

Any one who peruses the railway journals and notices the number of electric railways now in operation, and the still greater number of those in course of actual construction or projected, has cause for surprise, if he has not closely been following the course of events.

That electricity, by some of the present methods of its use, or by better ones yet to be invented, will entirely supersede the use of horses and cable traction upon all street railways, excepting under the special conditions for which cable traction is occasionally applicable, is a question that admits of very little doubt.

As may be imagined, this able paper received much attention and was remarkably well received, being regarded as so exhaustive as to leave few points to which inquiry could be profitably directed by way of discussion.

In the course of a paper on street railroad construction, Mr. Calvin A. Richards said:

"The time is fast approaching, if not already here, when electric motors will come into general use for the propulsion of our cars. When accumulators or storage batteries are used, our cars will have to carry an increased weight of 3,000 to 4,000 pounds. It is probable, also, that in time we shall find it profitable to replace our present cars with longer ones, capable of seating a larger number of passengers; all this will require heavier rails and better road, and we shall have to construct our tramways when building new tracks, or reconstruct our old ones for this purpose.

"A section of rail weighing from 55 to 60 pounds, with the cross-ties placed 4 feet apart, will be sufficiently stiff to answer the purpose. Great care should be exercised, however, to have every part of the track construction well and solidly done, especially at the rail joints, and the whole track rigidly held in place, so that inaccuracies in this respect will not cause the motors to leave the track, nor settle it and throw it out of place, by the increased weight and speed of our cars.

"In the light of the present progress of the electric motor system, these facts seem worthy of our consideration."

During the afternoon meeting of Wednesday, Mr. F. J. Sprague made the following address:

THE APPLICATION OF ELECTRICITY TO STREET RAILWAYS.

To be asked to say something to the members here comes to me rather in the form of a surprise, as I had come here only for a few hours to hear the practical suggestions and criticisms by the men who are operating the street railways of the country, and not to attempt to instruct them. On account of the limited time at my disposal, I can only briefly refer to the application of electricity to street railways.

As most of you are aware, there are three different systems by which it is possible to apply electricity to street railways: Overhead conductors, underground conduits and storage batteries. The overhead system in point of cost is the cheapest, and it is the only one up to the present which has been developed, and is in most frequent operation. The conduit system is receiving the attention of a large number of workers in this field, and unquestionably will be used in some cases where a large number of cars are in operation and where the return will be in proportion to the investment. The storage battery system is likewise in an experimental stage in Philadelphia, Baltimore, Boston, St. Louis and New York. We will soon have cars of different kinds and equipped with different makes of storage batteries in operation, some of them under our own and others under local control, and in this way we will be able to get hold of the practical views which on consideration may be of value to you. In point of cost the overhead line is of course the cheapest, and either this or the storage battery system will be the one to be used where there are only a few cars and where running under long headways.

The conduit system is of course to a certain extent preferable to the overhead line, as overhead wires of every kind, for whatever use, are objectionable, and possibly of a tentative character in view of the ultimate development of the storage batteries. The conduit system, as I have said, is in a somewhat experimental stage. It is impossible to put in such a system except by liberal investment of money, because it must stand the same strains and conditions of weather and traffic which a cable conduit must stand, and in addition must afford ample protection for the conductors on which the operation of the whole system depends. Such an investment of course cannot be made where cars are run at long intervals, because the traffic receipts would not afford a dividend sufficiently attractive on the investment. The storage battery offers the advantage over all others of perfect independence of action; but it has the disadvantages that the capacity of the storage battery is limited, the weight of the battery is large and the life and duration of it is somewhat uncertain. Storage battery companies are in the habit of guaranteeing their batteries for two years' operation, provided no unreasonable strain on their capacity is made. The system will soon be presented for your consideration.

The question of traction, which has been objected to by some street railway men, seems to have been met. We have had a car take a six per cent. grade, driven with only one pair of wheels. This may have been exceptional, and have been done under favorable circumstances, but it *was* done and over sharp curves, and if both axles are independently driven, not the one made dependent upon the other, there is no question about its being done under all circumstances. In the adoption of any system or any method of operating cars by electricity, the question of the number of cars to be operated is a most serious one. If operating one or two cars over five or six miles, electricity had better be let alone, and even when operating two or three cars the question of headway is important unless the power is derived from some existing station or under exceedingly economical conditions. There is a point in any system, whether overhead, conduit or storage batteries, in which a certain number of cars under certain conditions of station operation must be operated before the economy will exceed that of horse traffic; the greater the number of cars the greater economy.

The conduit has not only to withstand the strains and changes of the surface, but it has got to afford ample protection to the electrical conductors. The placing of wires under ground for lighting, telegraph, etc., has been very successfully done in several cities, but, even with the advantages of a supposed-to-be-well-protected conductor, many difficulties have arisen. When such a conductor, however, has its protection removed and is carried in an open conduit entirely exposed, without a good condition of drainage, such as appears in Boston, where oftentimes

in spring the water will collect in pools six or eight inches deep, it is useless to construct poorly or cheaply. You have got to put the money into the ground if you are going to have a system economical and free from accidents.

You ask: Would you use electricity on a line running six cars? If I were you and I believed in electricity I would certainly use it, as it would be more economical in that case than horses.

Mr. Cleminshaw asked what would be the cost of a 5 or 10 horse-power motor.

Mr. Sprague: I am not here to say what the price of motors is. But in plants of that kind there are four elements of cost; there is the steam plant, the dynamos, the apparatus which carries the electricity to the motors, whether it be overhead line, conduit system or storage battery, and finally the cost of the motors themselves.

As regards the probability of this application of electricity, I may instance the fact that we have now under way a contract at Richmond on which eleven miles of track are being equipped with forty cars to be operated with overhead line. The grades run as high as eight per cent., although ordinarily I do not favor going above six per cent. where I depend upon the rails for adhesion. This plant is to be operated from a power station which has been specially put in for it.

In the matter of handling excessive grades, it seems to me inadvisable to subordinate an entire system to a capacity which is necessary to climb some one grade which will occur. It would seem as if it would be advisable to use an independent motor or cable at the point where the grade occurs. For instance, if the ordinary grades on a line run two or three per cent., and there should be for a short distance a grade of seven or eight per cent., then instead of subordinating that entire line to this fact and putting on motors unnecessarily heavy for all ordinary conditions of work on the cars, it would seem advisable to equip the line for its nominal duties and at the excessive grade put in some additional source of traction. This would be found to be cheaper and more satisfactory.

Mr. Thurston says: "You have given some of the disadvantages of the conduit and storage battery systems; are there none to the overhead system?" Unquestionably there are. There is, as I have said, the unsightliness of all overhead wires; there is of course the possibility of a wire breaking, but if properly put up this ought not to occur. It must not be understood that I am here to promote or to advocate any particular system. I am just as firm a friend as any one can be of the storage battery, and hope just as much for its success as any one can, but I do not want to take the position of claiming more for any system than it can in honesty hold.

In regard to putting the motors upon cars, it would seem to me that, although greater care must be exercised in the construction of the motor, the proper place for it is under the car, out of sight. My own opinion and experience is that each axle should be equipped, in the case of a four-wheel car, and each truck, in the case of an eight-wheel car. Both because of the increased traction.

Not only ought they to be equipped but independently equipped, because in this way greater traction and much greater certainty of operation is secured on the track in bad condition, and especially in order not to obstruct the track because of any accident. Of course the object of every one should be to make as little change as possible in the recognized and accepted features of street cars, and in the application of motors to the cars absolute certainty of operation of axles, and flexibility so as to stand the shock of constant strains, should be sought after.

While the convention was in progress on Thursday morning, Mr. C. J. Van Depoele was called upon to address the delegates. He thereupon spoke briefly and forcibly on

THE ELECTRIC RAILWAYS IN AMERICA.

To illustrate what had been, and could be, done, Mr. Van Depoele outlined the work of his own company, and his statements may be summarized as follows:

Location.	Miles.	Cars.	Power.	Total power cost per day.
Windsor, Ont.	2	2	Steam, rented.	$4.00
Detroit, Mich.	2	8	Steam, rented.	6.00
Appleton, Wis.	5	5	Water.	4.50
Port Huron, Mich.	5	5	Natural gas.	2.00
Scranton, Pa.	4⅛	7	Culm.	7.00
Binghamton, N. Y.	5¼	6	Steam, rented.	10.00
Lima, O.	4	6	Crude oil.	4.00
St. Catherines, Ont.	6	6	Water.	3.00
Montgomery, Ala.	13	18	Steam.	14.00
Total	47	63		

In addition to these roads in operation Mr. Van Depoele has the following under construction:

Location.	Miles.	Cars.	Power.
Jamaica, L. I.	6	10	Steam.
Ansonia, Conn.	3½	4 and 1 loco. of 75 h.p.	Water.
Omaha, Neb.	7	10	Steam.
Dayton, O.	6	12	Steam.

Mr. Van Depoele stated that in no case did he reckon on less than 18 hours a day. In reply to various questions, he said he preferred one motor. It could be put on the front platform, where it could be seen and watched. In most cases it was sufficient to connect up with the front axle, but where heavy grades had to be ascended they belted from that back to the second. As to protection of the overhead circuit, they now placed a guard wire. Of course if telegraph or telephone wires unprotected by lightning arresters came in contact with the main, it was so much the worse for them and the office they ran from. The noise of an electric car was certainly no greater than that of an ordinary car, and should be less than that. The depreciation of the machinery was not in excess of 2 per cent. per annum if it was properly attended to. At Dayton, O., part of the circuit would be conduited, the conduit being 9 inches above the cross-ties, giving a gentle slope, as in cable roads, so as to drain easily away from the conduit. He thought a good conduit could be put in for $5 000 or $6,000 a mile. Speaking of grades, he mentioned that in Appleton there was a 10 per cent. grade, with a curve of 60 feet. Grades of 7 and 8 per cent. could be taken, provided there was a good sand box used. In Scranton they had grades of 7 and 8 per cent. As to trouble from sleet, etc., on the overhead conductors, he said that at first they had anticipated great trouble from this. In Scranton, for instance, although they had side guards on the trolley to break the ice, on one occasion it looked pretty bad. But the difficulty disappeared as soon as the car started, as the current passed through the ice easily and the trolley kept to the conductor. Every now and then there was a little flash, but that was all. With 25 cars in parallel on a double track he would use ¾ inch copper for each conductor, connecting them together so as to lessen the resistance and get the higher conductivity. The current per car he found to average about 10 ampères, but it would now and then go up as high as 25 or 30 ampères. He used a potential of 500 volts.

An interesting paper was presented to the convention on Thursday afternoon by Mr. E. E. Ries on

A NEW METHOD OF INCREASING THE TRACTIVE ADHESION OF DRIVING WHEELS.

Mr. Ries said:

"At the present time, when the question of substituting electricity for horse and cable power on street railways is receiving such earnest attention on the part of progressive railway men, the problem of obtaining the requisite tractive adhesion between the driving wheels of the motor cars and the rails under all the various conditions of track and weather is one of considerable importance. This question, moreover, must be satisfactorily solved before any degree of success can be looked for from the introduction of electric motors upon our present street railway lines. It is well known that one of the greatest obstacles hitherto encountered in applying motors, whether steam, compressed air, electrical or any other kind, to the operation of street railways has been the difficulty of securing sufficient adhesion between the driving wheels and track in wet weather, or when the tracks were covered with snow and slush, this being especially noticeable on railways having grades of more than ordinary steepness, such as abound in nearly every large city. In this respect cable and horse lines have always had the advantage because of the application of the tractive force outside of the car itself and, therefore, independent of the amount of friction or adhesion between the wheels and track rails. As the ordinary street car rails are necessarily level with the street surface, they do not permit of the same tractive effect as the elevated rails commonly used on steam and suburban railways, and a motor car running with perfect ease during the winter on a suburban railway would make little or no headway on a city line of equal grade under the conditions named."

Mr. Ries then went on to describe his method of increasing adhesion by electro-magnetic devices, as described in our columns last week, and illustrated his remarks by two models.

Mr. R. W. Blackwell addressed the convention on the subject of electric railways and gave expression to his well known views in regard to the uselessness of storage batteries for street railway purposes. He submitted, on behalf of the Bentley-Knight Company, the following argument:

The Bentley-Knight Electric Railway Company begs to submit its criticism upon the use of the storage battery for street railway purposes.

No idea could be more attractive than that of a self-propelled car, carrying within itself its own energy—independent of any connection with line wires—and dispensing with expensive conduits and unsightly elevated conductors. On the advent of an apparently practicable storage battery, in 1881, all these advantages were claimed for it. It shortly demonstrated its utter worthlessness as an adjunct to commercial electric lighting, but its promoters claimed that it possessed a peculiar fitness for tramway use. It has been paraded through every city of Europe, and has, to judge from press comments and *ex parte* statements, never failed to make most successful and startling exhibitions. The boom has now reached this country, and New York, Philadelphia and Boston have each been favored by the attention of the several inventors and their exploiting companies. Since the European experiments of 1882, little or no material progress has been made in the practical use of the storage battery for street car purposes, and it is our belief, based on most careful investigation, that its radical structural difficulties cannot be overcome. It would be profitless to discuss them here; nor will we dispute the allegations as to weight, efficiency, etc., which the enthusiastic promoters make.

We will assume that the storage battery is beyond the experimental stage, capable of driving a car eight hours without recharging. Granting the most favorable premises, we will make a short practical comparison between the storage and direct systems, both as to operating expenses and first cost. We will also assume that a set of street car batteries will weigh 3,200 lbs.; that they will give a return of 65 per cent. of the electrical energy expended in charging; that a set which will run 8 hours can be charged in 10 hours, and that a set will run 12,500 miles without renewal of the batteries or extensive repairs.

1st. Cost of Operation.—Two great losses are chargeable against the economy of the storage system, viz.: Loss in conversion of energy in the battery and the additional weight carried on the car. In the direct system, electricity from the generating dynamo is transmitted to the motor on the car by the line conductors. In the storage system, electricity from the dynamo is used to charge the batteries, which, in turn, supply the motor. In the latter system the loss is conceded to be 35 per cent. In the former system, it is a matter of simple arithmetical calculation to make the loss inappreciable. It should never exceed 5 per cent., however long the line. This leaves a difference of 30 per cent. against the storage system.

A greater loss is entailed by the heavy load of batteries which the storage system car must carry. It necessitates a heavier car construction and a heavier motor, all of which adds to the weight. In practice two motors are often used. The additional weight entailed by the storage system easily reaches 4,000 lbs. per car. The motor and driving mechanism for a car, run under the direct system, weighs 1,600 lbs. The equipment where batteries are used is necessarily heavier on account of the added battery weight to be moved, but we will keep the same figure for both. A car weighs nearly 5,000 lbs. In Boston (1886), the average number of passengers per car mile was 10, so that the average load may be put at 1,400 lbs. We then have the following summary:

	Storage system.	Direct system.
Car	5,000 lbs.	5,000 lbs.
Motor, etc.	1,600 lbs.	1,600 lbs.
Passengers	1,400 lbs.	1,400 lbs.
Batteries, etc.	4,000 lbs.	.....
	12,000 lbs.	8,000 lbs.

That is, 50 per cent. more power must be expended to propel the storage car, and 30 per cent. more power to overcome the loss of conversion in the batteries, making a total of 80 per cent. greater cost for power than the direct system. This means not only 80 per cent. more coal consumed, but 80 per cent. added to the size and cost of the steam and dynamo plant in the generating station.

There are additional losses in the storage system which are less easy to compute, but which are hardly less serious than those mentioned. Twelve thousand five hundred miles are given as the life of a battery. Now 100 miles per day is not an excessive mileage for an electric car, so that the battery must be renewed, wholly or in part, every 125 days, or three times per year. What this would cost it is impossible to say, but it is plainly a serious item. On the other hand the depreciation of an overhead wire, or a conduit, is very slight, not more than 3 or 4 per cent. per annum. The handling of storage batteries is also a very considerable item. To tranfer 3.200 lbs. into and out of a car two or three times a day is not a slight matter, while the shifting and removal necessary to a large plant must be added to it. None but skilled labor could be employed in handling, recharging and taking care of the batteries. That has been conclusively proved.

2d. First Cost of the Storage System.—There is little reliable data on this point, but putting a very moderate estimate upon it, it far exceeds that of the most expensive direct system.

There should be at least three sets of batteries for each car—a considerable increase in the motor capacity—80 per cent. more dynamo and steam plant in the generating staton, and twice the floor space, since each car must have a stand for charged and discharged batteries. This could not cost less than $2,500 per car, which is to be balanced against the conduit and line conductors of the direct system. The cost of the latter varies, of course, with the number of cars per mile. Taking a well-known road in Boston, however, which has 700 cars and 70 miles of track, there are 10 cars per mile which, equipped with conduit and conductors at $4 per foot, would cost $2,000 per car. As a matter of fact, one-fourth of this mileage could be equipped with overhead wire at $2,500 per mile, which would bring the cost to $1,650 per car.

An important fact which we have left out of this computation is that most existing roads must be equipped with new and heavier track to fit them for the weight of storage cars. The present rail will stand an addition of 1,600 lbs. to each car, but not an addition of 5,600 lbs. (The most widely advertised storage car run in this country weighed over 6¼ tons.) These facts are plain and simple, and in view of them it is difficult to see how the introduction of the storage system can be seriously contemplated when conduit and elevated conductor roads on the direct system are feasible. As we have said before, the superficial appearance of the storage battery for street cars is very attractive. It is a simple electrical problem to charge a battery and run a car for an occasional trip. A boat equipped with a battery has crossed the English Channel, while for lighting railway trains, where weight and expense are no object, and the work easy and constant, it has a certain value, but for practical street car work, it has just enough promise to make it a dangerous and insidious deceit. The storage power, however, is a disease which users of electricity must go through as a child has the measles. The electric lighting interests went through it some years ago at an enormous expense, and to-day not one of the large electric lighting companies is supporting the storage battery. If this paper, hurriedly written and far from complete, will in any degree mitigate the malady to the street railway interests, it will have attained its end.

On Friday morning, by special invitation, the convention, accompanied by the wives and daughters of many of the delegates, paid a visit to the works of what is to be known as the Electric Car Company of America, at Washington avenue and Twenty-third street. Mr. Wm. Wharton, Jr., is at the head of this new and important enterprise, which has the advantage of enjoying the services of Mr. Anthony Reckenzaun, and which controls the patents of Mr. R. M. Hunter and others. The company intends to build its own motors and storage batteries at these works and to equip cars there for electric railways of every description. On a part of the grounds a large circular track is laid, with sharp curves and heavy grades, and here the merits of the various cars are to be demonstrated. On the present occasion, the company were shown a car intended to run with overhead connection, and were given frequent rides around the track in the car equipped with Sprague motor and Electrical Accumulator cells which has been in such successful operation for the last two or three months. A fine new car, with twin Reckenzaun motors and worm gear, driven by E. A. cells, was near the point of completion, and an effort was made to run it before the visitors left; but the car switch, imported from England, was found very defective, a section burning out before the test could be made. Later in the afternoon, the switch was repaired and the car made some excellent trips; so that the street car men before they left on Saturday were able to see how easily electricity could be thus applied and handled.

A sumptuous lunch was provided by Mr. Wharton at the works, and both he and Mr. C. A. Richards, in speaking during the lunch, renewed the expression of their confidence in storage cars. Mr. Wharton said he did not feel "sanguine" on the subject, but "certain," and that in taking part in the revolution now going on in street railway work he preferred to be in the front and to lead, even if alone. His remarks were exceedingly well received.

Another Injunction.—Judge Thayer, of the United States District Court at St. Louis, has enjoined Rose & Rein from the manufacture of telephones, which the firm had been selling extensively in the West and Southwest.

New York City.—Mayor Hewitt, as a member of the Subway Board, has reached the point of protesting against more conduits for the present, because "this continual tearing up of the streets had come to be an intolerable nuisance."

The Cleveland Motor Company, Mr. C. A. Brayton, president, and Mr. C. L. Wright, manager, announces that it has bought out the Cleveland Electric Motor Company. Its main office will be at 406 Broadway, this city, and its factory in New Jersey. It will build motors from one-half to 25 h. p.

A Pool Suit.—A dispatch of Oct. 23 from Paris says: "A suit has been begun by the Anglo-American and Direct Cable companies against the French Cable Company demanding damages because the French company withdrew from the cable pool, or the return of $1,200,000 which the French company received from the pool in excess of its earnings. The suit comes before the Paris Tribunal on Tuesday."

The Ries "Combination" Conduit for Electric Street Railways.

Foreseeing the time when electric street cars will take a prominent place in urban passenger traffic, and taking into consideration also the growing antipathy to overhead wires in large cities, Mr. Elias E. Ries, of Baltimore, Md., has recently designed a "combination" conduit, in which provision has been made for the requirements of both the classes of service above mentioned.

The conduit, which is shown in perspective in Fig. 1, is drawn partially exposed, to illustrate the construction and arrangement. In Fig. 2 is illustrated a form of bracket for a double-track railway, cast in a single piece, and having flanged openings for the reception of wire ducts, pneumatic tubes, etc.

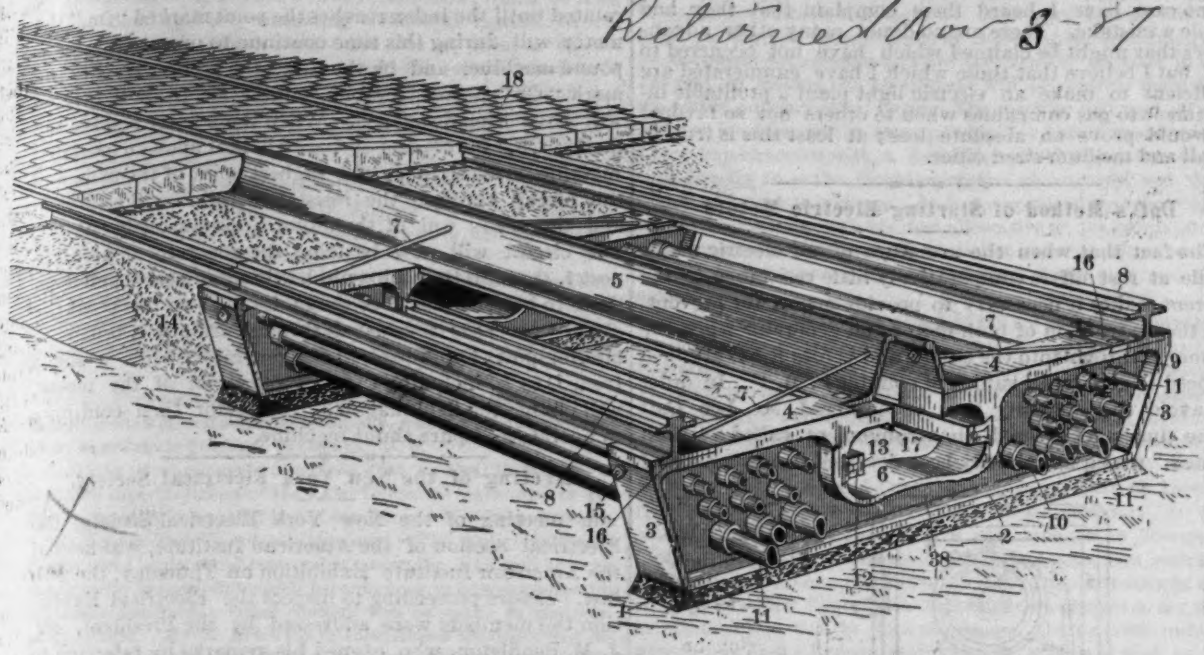


FIG. 1.—THE RIES COMBINATION ELECTRIC CONDUIT.

This view also shows the conduit channel with its containing supply-conductors, and the arrangement of the track and slot rails. Fig. 3 shows an ordinary cable railway conduit, provided with electric railway conductors, arranged in such a manner (with respect to the cables and grips) that the conduit may be utilized simultaneously by both systems. This construction is of importance where an electric railway is required to turn into a street already occupied by a cable conduit.

As will be seen in Fig. 1, the supporting brackets are placed in a shallow trench at intervals of four feet apart, and rest upon cross-ties of concrete in order to insure a solid foundation. These brackets have a flanged central opening 6, forming the conduit channel, and on their upper surface they are recessed for the reception of the track and slot rails, respectively. The track rails are of the girder type, and are self supporting between the brackets, and they are secured in place by a locking plate 16, so as to permit of renewal without disturbing the conduit structure. The width of the conduit slot, which in this system is one-half inch, can be regulated by means of the adjustable tie bolt 7. The construction is such, however, that no perceptible variation in the width of the slot, or in its distance from the rails, is possible.

The walls of the conduit opening are provided with undercut recesses that serve to hold insulators 12, which are secured in place as the construction of the conduit progresses. Within these insulators the supply conductors 13 are afterward inserted, these conductors being free to expand and contract by reason of the "slip-joint" support thus formed, while at the same time they are sufficiently rigid to bear the pressure of the current-collecting wheels that travel in a horizontal position between the two conductors. The conduit channel is provided with drainage outlets at proper intervals, and the brackets have depending ribs 17 that serve to deflect any water that may enter the conduit slot and cause it to drop clear of the conductors 13. It will be noticed that the conduit brackets are cast with a series of flanged openings 10 at both sides of the conduit channel. These openings serve as a support for paper tubes or ducts that are prepared in a special manner and impregnated with asphaltum to render them moisture and gas proof. These tubes extend from the centre of one bracket to the centre of the next so as to form practically continuous tubes, and are hermetically sealed with liquid asphalt poured around a joint of special construction formed upon their ends. When the tubes between two or more brackets are in place the space between the brackets and around the conduit channel is filled with a suitable cement or concrete, which securely imbeds and protects the tubes and serves as a support for the paving blocks, thus making an extremely smooth, solid and durable road-bed and street surface. At intervals of one or two blocks, manholes are provided for gaining access to the ducts or tubes, and for making connection between the conductors or wires carried in the main conduit and those of branch or distributing conduits at street intersections. The interior of the paper ducts is perfectly smooth, and the additional expense for providing and laying them is claimed to be comparatively slight, so that in localities where the burying of overhead wires is receiving consideration, this class of conduit finds a use.

Owing to the novel form of current collectors employed in the Ries electric railway system, the depth of conduit channel necessary is but 6 inches, and the entire depth of the conduit shown in Figs. 1 and 2, measured from the street surface, does not exceed 18 inches, which reduces the cost of the same and obviates the various underground obstructions common to deeper excavations.

It will be apparent that the wire ducts are not essential to the conduit, but may be omitted in localities where they are not required, without interfering with the general construction shown.

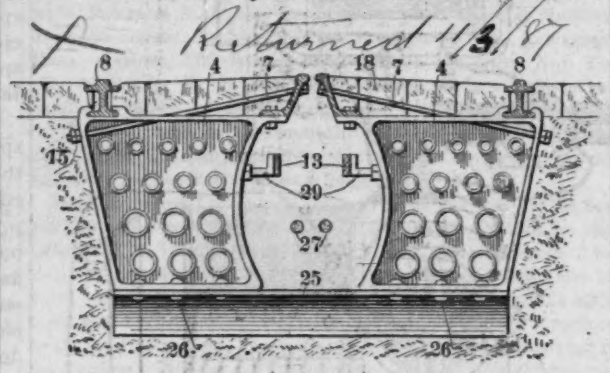


FIG. 3.

Mr. Ries, we understand, has devised a number of conduits differing in many respects from those forming the subject of the present article, which are specially adapted to the requirements of different localities and systems of operating. A special feature of all these conduits is that they are interchangeable; that is to say, the distance between the supply conductors and their depth below the street surface is the same in all cases, thus permitting motors of one railway to run with equal facility on to another line provided with a different class of conduit.

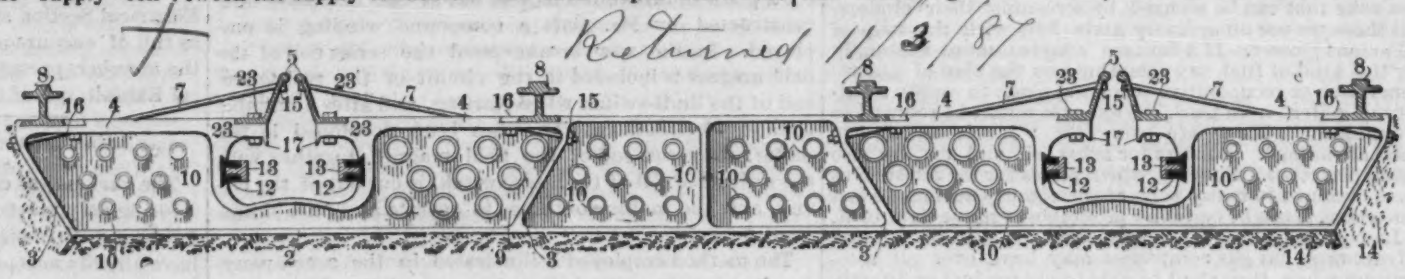


FIG. 2.—THE RIES COMBINATION ELECTRIC CONDUIT.

Lightning Conductors.

The *Elektrotechnischer Anzeiger* describes a method patented by Messrs. Hoyer and Glahn, of Schönebeck on the Elbe, who use an insulated copper wire introduced into the conducting apparatus and wound round an iron core. Over the core is suspended a magnetized steel plate. The latter communicates with a registering appliance, by which its movements are recorded. When a current of electricity passes through the conductor the iron core becomes magnetized and attracts the corresponding pole of the plate. After the cessation of the magnetic action the small plate will remain in its position. From the position of the indicator it is possible to determine whether lightning has passed through the conductor. In order to restore the apparatus to its original condition the indicator is turned back, the plate liberated and again suspended. It is stated that several hundreds of these appliances are already in use.

Notes on the American Institute Electrical Exhibition.

We continue below our notes on the displays at the Electrical Exhibition.

STANDARD UNDERGROUND CABLE COMPANY.

The Standard Underground Cable Company make a very neat and attractive exhibit, including all the well-known lead covered wires and cables for electric light, telegraph and telephone purposes. They show specially a section of 200-conductor cable made for the Chicago Telephone Company, 19-conductor for the Western Union Company, New York, and 30-conductor for the same company.

THE BUTZ HEAT REGULATOR.

The Butz thermo-electric regulator, which was described in our columns recently, is exhibited by Messrs. J. H. Benham & Co., of this city. There can be seen a Boynton furnace to which the regulating motor is attached and from which wires lead to a thermostat. Near the latter is placed an adjustable gas bracket so that the flame can be brought near the thermostat. When this is done the thermostat closes the "hot-circuit" and the regulating motor makes a half revolution, which checks the draft so that the consumption of fuel is retarded. When the thermostat has again been cooled sufficiently to bring it over to the "cold circuit" contact, the regulator attached to the furnace again makes half a revolution so as to open the damper and admit a full draft to the furnace. Visitors are much interested in the simplicity of the apparatus.

THE BALDWIN GAS ENGINE.

While we are probably near the time when electricity will be generally available by distribution from central stations, its advantages, especially for illumination, are such that many private individuals prefer to install their own power plant for driving the dynamo. A very neat installation of this kind is shown at the exhibition, where a Baldwin gas engine of 4 h. p., exhibited by Otis Brothers & Company, drives a Weston dynamo, lighting up 32 16 c. p. lamps. The visitor is at once struck with the entire absence of noise in the running engine. The latter takes gas, and gives an explosion at each revolution so that the speed is very constant, as shown by the steady brilliancy of the lamps, which are suspended from a canopy over the exhibit. The regulation of the engine is well provided for and a novelty in it is the method of igniting the gas in the cylinder. For this purpose a very small current is taken from the dynamo so that no flame is necessary. For starting, however, when the dynamo current is not available, a small magneto machine is employed, but this is disconnected as soon as the machine is up to speed. The engine is said to be very economical of gas.

The Dissolution of the Pan-Electric Company.

The following special dispatch from Washington of Oct. 12 reveals an interesting state of affairs in the Pan-Electric Telephone Company:

The suit of J. Harris Rogers vs. Augustus H. Garland et al. is No. 38 on the calendar of the Supreme Court of the District and will probably be reached before many days. It will be remembered that Mr. Rogers, of Pan-Electric notoriety, brought a suit in the Equity Court here last winter against Attorney-General Garland, Senator Harris, Casey Young, General Johnston and J. D. C. Atkins, praying for the dissolution of the Pan-Electric Telephone Company. Mr. Garland filed an answer to Mr Rogers' bill, surrendered his stock to the court and joined with Rogers in praying for a dissolution of the company and a settlement of their accounts. The council for the other parties, however, although it is said that Mr. Garland urged them to follow his course, filed a demurrer to Mr. Rogers' bill, and when the case came up for trial before Judge James the demurrer was sustained, and Mr. Rogers was informed that he had no case. An appeal was taken to the Court in Banc, or Supreme Court of the District. The case will come up on the appeal very soon now, and owing to the prominence of the parties concerned, it will attract general attention.

In a recent interview Mr. Garland talked very freely

about the matter. "When Mr. Rogers," he said, "brought his suit for the dissolution of the Pan-Electric Company I was very willing to join in his prayer. I accordingly did so and surrendered my stock or interest in the company to the court, washing my hands of the affair. Since then I have paid no attention to the matter. I understand, however, that counsel for General Johnston and others filed a demurrer to Mr. Rogers' bill, which was sustained by the court. I do not know how the appeal will be decided. So far as I am concerned, having surrendered my interest to the court, I have given it no further thought."

The Advantages of Gas Companies Engaging in the Electric Light Business.*

BY E. J. KING, JACKSONVILLE, ILL.

That the electric light must either be looked upon as a rival interest and active competitor, or a part of the gas undertakings of this country can no longer be doubted.

I take it that your committee, in assigning me this subject, had in mind the discussion of the question whether or not the advantages that gas companies may have over all others are such as to warrant them in the necessary outlay for the installation of a plant, with not only the possibility but probability of competition.

From the number of companies "joining the ranks," I think it has been decided that it may be considered a legitimate part of our business. That with a properly constructed plant, conducted on business principles, it can be made a profitable investment, I no longer doubt.

In a reported interview with a manager of a large electric light system, he is quoted as saying that he did not advocate the policy of selling to gas companies, as they would not endeavor to push the light as others would who depended solely on this light for their business. It seems to me that he could not have looked very far ahead, for when gas companies shall have taken hold, and made it a part of their business, he who has courted their trade will certainly come out in the lead.

I do not believe that electricity is to drive gas for illumination out of the field, and that we can be comforted by knowing that our existing plant is to be devoted exclusively to "sending out" fuel. I do believe that there is a place for electricity, and we, as gas men, are the proper ones to supply it, and that the time is coming when it will be so considered by all.

There is a good deal of philosophy in the reply of a certain gas man who was asked if it were true that his company was going to enter the electrical field. He replied, "Yes, and I should not be surprised if we were selling coal oil before long. We are in the light business."

So far the competition of electric light has not seemed to diminish the use of gas to any extent; in fact, most companies report not only the average but even a larger increase than usual in their "send out."

If the use of electricity continues to increase as it has in the last few years, will this always be true?

In our section of the country the arc light has almost superseded gas for street illumination.

All buildings in course of construction of any size or importance in the various cities of the country are being wired for incandescent lighting. The report comes that all manufacturing establishments supplying electric lighting material are far behind their orders.

Does all this mean that after six or seven years use it has been found unprofitable to engage in electric lighting, or that the demand is growing less?

Undoubtedly there have been failures and unprofitable investments in this field, but has it been the rule?

I certainly have heard of no gas company that has tried the experiment and failed.

Now let us see what advantages the average gas company may have.

First, I would say in saving on cost of installation. The probability is that all companies can find the small piece of ground necessary, on the property they own, and may be sufficient room in present buildings by rearranging and economizing in space. For necessary foundations a grout made of old retorts, old fire-bricks and refuse of various kinds broken to the proper size can be utilized with spent lime (which is almost as good as cement for this purpose).

Second, the saving in expense of management cannot be questioned. That with the force necessary a part of the gas plant fewer new men will be needed must be apparent.

Third, that gas companies have a certain amount of refuse that would otherwise be waste which can be used for fuel. For instance, coal dust, coke breeze and more or less coke that can be secured by screening their cinders. All these we use on ordinary grate bars with the help of a Parsons blower. If a furnace adapted more especially for this kind of fuel, say something on the plan of our regenerative or recuperative furnaces made to supply a battery of boilers were used, the expense might be reduced to a minimum. Many are using the "Jarvis setting" to good advantage. Burners for using oil and tar are also being perfected. Possibly when prices for tar are such as have obtained in many parts of the country during the last few years, it might be found profitable to make light of it.

Lastly, fuel gas. Who can realize the possibilities and advantages that gas companies may have over all competitors when they shall be able to use for fuel or directly in the engine a gas that shall cost them but from two to three cents per thousand cubic feet? This, you know, we are promised.

In several discussions in our Western association it has been argued that interest on the proportion of value absorbed from the existing gas plant in construction, and its proportion of the expense of managing, etc., should properly be charged up to electric light, which would decrease the reported per cent. of profit. Grant this to be true, but would you not then have another advantage to gas companies, in that their expenses would be decreased just so much, the result to the stockholder however being just the same in dollars and cents?

Now may it not also be an advantage to the consumer? It has been the history of gas companies that they have endeavored to furnish gas at as low a price as possible in justice to themselves, the "dollar mark" being the dream. May we not expect them to carry the same policy into any new departures? I know this to be the feeling of the directors of the company I have the honor to serve.

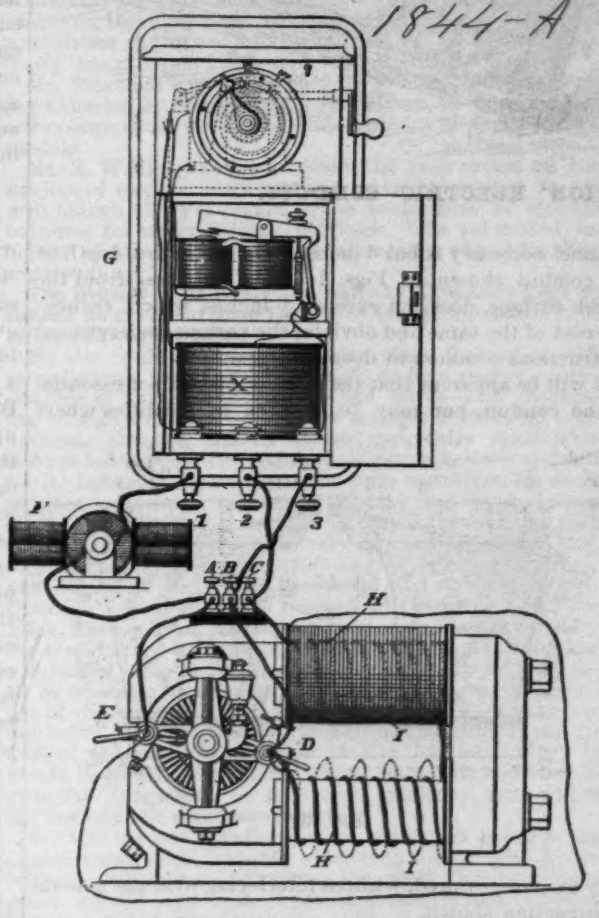
Taking hold of the electric light when a local company had made a failure of it, they have reduced the price from $12 and $15 a month for an eleven o'clock circuit to from $6.25 to $8 for a twelve o'clock circuit. What company in the country without competition is selling an arc light at this price? What company can do so and pay satisfactory dividends with only a 68-light plant, unless it be a gas company? Is it not true also that men educated to the business of furnishing light will understand the necessities and wants of their patrons better than men who have suddenly entered a new field?

The tendency of the day is to trusts and combinations generally with the understanding that a great saving may be expected. How truly this may be applied to the question we have now under consideration. I have corresponded with and talked to quite a number of the members of gas companies who have made such a combination, and in no case have I heard them complain that they had made a mistake. There are no doubt many other advantages that might be claimed which have not occurred to me, but I believe that those which I have enumerated are sufficient to make an electric light plant a profitable investment to gas companies when to others not so favored it would prove an absolute loss; at least this is true in small and medium-sized cities.

* Read before the American Gas Light Association, New York, Oct. 20, 1887.

Daft's Method of Starting Electric Motors

The fact that when the armature of an electric motor while at rest offers comparatively little resistance to the current makes it necessary to provide means for preventing the destruction of both motor and generator when the former is thrown into the circuit and before it has attained a speed to generate a sufficient counter E. M. F. In order to avoid the difficulty thus encountered, Mr. Leo Daft some time ago devised an arrangement called a "limit switch," which has already been decribed in our columns.*



Daft's Method of Starting Motors.

This switch operated so as to insert a resistance in the circuit of the armature of the motor when the latter was started, and was so arranged as to cut out the resistance when the motor had gained sufficient speed to generate an appreciable counter E. M. F. This switch was designed for a plain shunt-wound motor, but in the machines now constructed by Mr. Daft a compound winding is employed. In the new arrangement the series coil of the field magnet is included in the circuit of the resistance-coil of the limit-switch when starting, and after a suitable counter electromotive force has been developed in the motor, the series coil of the field magnet, together with the resistance coil of the limit switch, is cut out of the circuit, and the motor continues to operate as a pure shunt-wound machine.

The method employed is illustrated in the accompanying diagram, the switch *G* being essentially the same as that already described by us, with a slight modification to adapt it to the new winding employed. In addition to the binding post 1 and 3 employed in the first form a binding post 2 is used, which is connected with the resistance *X*. The motor, as will be seen, has a series or primary coil *H* and a shunt coil *I* on the field magnets.

The circuit from the generator *F* at the central station is led to the binding post 1 of the switch and to post *A* on the motor. There are two more binding posts *B* and *C* upon the motor. The one *B* is connected to the brush *D* and the other *C* is connected with the series coil *H*. Besides this, post 3 is connected with post *B* and post 2 with post *C*. At brush *D* terminate one end of each of the primary and secondary coils, and the other end of the secondary coil is connected with brush *E*. The circuits through the apparatus can thus be easily traced.

If the crank of the limit-switch is turned so that the index will be at the point marked "off," the contact-strips in the limit-switch will be on an insulating section of the cam and the circuit will be broken. But if the crank be turned to bring the contact springs upon metallic sections of the cam the circuit will be closed and the motor will operate as a compound machine, the circuits being as follows: From generator *F* to binding-post 1 of the limit-switch, through the switch and resistance-coil *X* to binding-post 2 and *C*, through primary coil *H* of the field-magnet to brush *D*, through the armature, brush *E*, binding-post *A* and back to the generator *F*. At the same time there will be a branch from brush *D* through the secondary coil *I* to brush *E*. If now the handle of the limit-switch be further rotated until the index reaches the point marked "On," the motor will during this time continue to operate as a compound machine, and by the time the pointer reaches the mark "On" a considerable counter electromotive force will have been developed. When the pointer reaches the mark "On," the contact-springs will bear upon an insulated metallic cross-strip at the highest point of the cam, and the circuit through the resistance coil *X* will be broken and the series coil of the motor simultaneously cut out. The circuit will now be from the generator to binding-post 1, through the limit-switch to binding-post 3, and from there to binding-post *B* of the motor. From this point the circuit proceeds to brush *D* through armature, brush *E*, binding-post *A*, and back to the generator, while a shunt from *D* to *E*, including the secondary coil of the motor, will charge the field magnet. The motor then continues to operate as a pure shunt machine.

* See The Electrical World, May 22, 1886.

Meeting of the New York Electrical Society.

A meeting of the New York Electrical Society, the Electrical Section of the American Institute, was held at the American Institute Exhibition on Thursday, the 20th inst. Before proceeding to inspect the Electrical Exhibition the members were addressed by the President, Mr J. M. Pendleton, who opened his remarks by referring to the fact that instead of the 7,500 square feet, and the 250 h. p. boiler capacity originally requested from the American Institute, it had been found necessary to ask for a supplementary 10,000 feet and 300 h. p. Notwithstanding this large accession to the requirements of exhibitors Mr. Hull, the General Superintendent, had been equal to the task of successfully meeting every contingency.

As an educational medium it was impossible to estimate the value of the present exhibition, and in this respect the Cuttriss recorder, Prof. Elihu Thomson's electrical welding method, and other exhibits, had each a special bearing which would be far more effective and lasting than all that had been written concerning them.

In defining the progress of electricity Mr. Pendleton spoke of this as the Electrical Age in contradistinction to the ages of stone, of bronze and of iron, and by way of confirmation drew a comparison between the year 1837, prior to which the lightning conductor was probably the only instance of the practical application of electricity, and the present day, when electric motors, electric railways, electric lighting and the numberless applications of electricity in everyday life not only show what has been done, but also indicate the marvelous developments that are in the near future.

The historical exhibit of the Society was one possessing rare interest for all classes. It contained a portrait of Benjamin Franklin painted by Sully, some of Franklin's original apparatus and many other valuable contributions, for which the society was indebted to the kindness of the Franklin Institute, of Stevens Institute, of Prof. P. H. Vander Weyde and others, and the Committee on Exhibits had largely contributed by their energy to the success of the display.

The President paid a tribute to the usefulness of the American Institute, and referred to the progress of the Electrical Section as most gratifying, and to its prospects as full of encouragement. He concluded by requesting the members present to register their names at the Historical Exhibit, out of compliment to the committee.

Gas Companies and Electric Lighting.

The various gas companies of the United States are considering very carefully the question of combining electric lighting with their gas plant. Many of the companies have already accepted the situation and have now become earnest advocates of a combination. We have been furnished with the following gas companies that have adopted the American system of electric lighting:

Brookline Gas Co., Brookline, Mass.	150 lights.
Citizens' Gas Co., Jacksonville, Fla.	100 "
St. Paul Gas Light Co., St. Paul, Minn.	500 "
Citizens' Gas Co., Jackson, Tenn.	50 "
New Albany Gas Co., New Albany, Ind.	50 "
Citizens' Gas Co., Orange, N. J.	50 "
Columbus Gas Co., Columbus, Ind.	50 "
Glens Falls Gas Co., Glen Falls, N. Y.	100 "
Halifax Gas Co., Halifax, N. S.	100 "
Meriden Gas Co., Meriden, Conn.	150 "
Oswego Gas Co., Oswego, N. Y.	35 "
Paris Gas Co., Paris, Texas.	35 "
Portsmouth Gas Co., Portsmouth, Va.	100 "
Saratoga Gas and Electric Light Co., Saratoga, N. Y.	175 "
Schenectady Gas Co., Schenectady, N. Y.	35 "
Seattle Gas Co., Seattle, Washington Territory.	100 "
Tacoma Gas Co., Tacoma, Washington Territory.	50 "

The majority of the above companies find the electric light working so satisfactorily and so much more profitable in connection with gas than at first anticipated, that they are now contemplating increasing their arc light apparatus.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, Oct. 24, 1887.

I hear that the enterprising firm of Knapp & Hague, 52 Fulton street, have been appointed New York agents of the Campbell Electrical Supply Company, of Boston, who are the manufacturers of the well-known Campbell line wire.

The Shaver "Standard" telephone is the latest production of Mr. George F. Shaver, of acoustic telephone fame. The Shaver Corporation, of 157 Broadway, are offering this new instrument as the latest and best of Mr. Shaver's inventions in this line. It consists of two concave nickel discs, about 8 inches in diameter, brazed together so as to leave a cavity or hollow, which is filled with another disc of "insulating" material capable of resisting any strain. Each outer disc has a hole in it. At one hole the mouth is placed, and the other receives a tube, which allows the telephone to be placed at any angle and through which the conductor is carried. The inner disc is left solid. A button over a washer is put on the transmission side, and the wire is connected to it on the opposite side. The corporation has also a new electric typewriter of Mr. Shaver's design, and a number of other specialties. Mr. Andrew Powell is the president, Mr. F. H. Walker, secretary and treasurer, and Mr. Shaver, vice-president and general manager.

The Edison light is to be installed in the new Broadway Theatre, Mr. H. A. McLean having secured a contract for 1,100 lamps of 16 c. p. Mr. C. A. Benton has secured another order. from the Utica Insane Asylum, where 1,000 lights are to be put in.

Mr. J. Hutchinson, the well-known general manager of the Edison United Manufacturing Company, was married on October 19 to Miss Jennie Torriani, at Oceanic, N. J.

Speaking of marriages reminds me that on Oct. 15 Mr. W. A. Vail, the superintendent of the Law Telephone exchange at 140 Fulton street, was married to the daughter of Mr. Robert Brown, of the Metropolitan Telephone Company. The happy pair went South, and I understand that on his return Mr. Vail will have his duties very largely increased, becoming superintendent for the exchanges generally. Other changes will be made in the company, I hear. Mr E. Eckert is to superintend the important department of private lines, Mr. J. A. Seely will have the electrical work to look after, and Mr. Helvin, of the Baltimore & Ohio Company, comes into the construction department.

Mr. H. F. Holloway has charge of the Eastern department lately opened by the Akron Iron Company at 39 Park place, where he is carrying a full stock of steel rim pulleys, Brock friction clutch pulleys, couplings, hangers, Norway iron rivets and power transmitting machinery in general.

I hear that the Standard Underground Cable Company is now making a specialty of the manufacture of office wire and a new form of underwriter's wire, for which strong claims are put forward.

Chas. A. Schieren & Company report sales of leather link belt during the past week to the following: Dover Electric Company, Dover, N. H.; the Wilmington City Electrical Company, Wilmington, Del.; W. B. Thom & Company, Haverhill, Mass.; Chicopee Manufacturing Company, Chicopee Falls, Mass.; Hart Lot Paper Company, Hart Lot, N. Y.

The *Sun* of October 23 gives an interesting popular account of the new telephone exchange for this city, and it says that in a few days 129 girls will be "helloing" there. In regard to the long-distance business, it remarks: "The long-distance telephone system is now principally used by manufacturing and other companies who have offices in this city and factories or branch offices in other cities. The Pennsylvania Railroad has a special wire, which it can use at any time and call up any of its numerous employés on different sections of the road. The Meriden companies use them to transact all the business between their offices here and their factories in Meriden. Rates are fixed according to the amount of business a subscriber thinks he would wish to transact. For instance, the Ansonia Brass Company pays for what is called a third of an hour. It has the privilege of talking ten times a day over a certain wire for twenty minutes each time. To conform to this arrangement the messages to be sent are kept as memoranda till their turn comes to talk, and then they call the men in the factory for whom there are instructions and give them to them."

Recently I had occasion to inspect the factory of Messrs. Einbigler & Adler, 433 and 435 Seventh avenue, in this city. This firm, beside being engaged in the manufacture of specialties in bronze, brass and iron, devote considerable attention to electrical work and manufacture gas-lighting apparatus and the Einbigler stock exchange annunciators. The latter apparatus was shown to me in operation, and is quite ingeniously gotten up. Where a large number of stocks are listed it becomes necessary to economize as much as possible in the space occupied by the annunciator board, so that a single glance can easily take in all the quotations. In order to accomplish this object the Einbigler annunciator is so constructed that the drop constitutes the lower half of the figure, so that when closed the latter half folds over the upper half like the cover of a book. The drops are worked by push buttons, one releasing the lower half so as to expose the figure and the other button drawing the drop up and covering up the figure exposed. The magnet which effects these motions is constructed to give a specially strong pull, having eight free poles and three armatures. The drop is of the balanced gravity type, and requires very little power to operate it. An annunciator board of this type is now in actual daily use at the New York Stock Exchange, and an addition of 340 drops is now being made to those already in service. Messrs. Einbigler and Adler also manufacture house, hotel and burglar alarm annunciators with the same type of gravity drop.

Mr. T. A. Edison is quoted as follows in regard to his phonograph: "After eight months of steady work I have made a commercial invention. My phonograph I expect to see in every business office. The first five hundred will, I hope, be ready for distribution about the end of January. Their operation is simplicity itself and it cannot fail. The merchant or clerk who wishes to send a letter has only to set the machine in motion and to talk in his natural voice and at the usual rate of speech into the receiver. When he has finished, the sheet or "phonogram," as I call it, is ready for putting into a little box made on purpose for the mail. We are making the sheets in three sizes, one for letters of from eight hundred to one thousand words, another size for twenty-five words and another size for four hundred words. I expect that an arrangement can be made with the post office authorities, enabling the phonogram cores to be sent at the same rate as a letter. The receiver of a phonogram will put it into his apparatus, and the message will be given out more clearly, more distinctly, than the best telephone message ever sent. The tones of the voice on the two phonographs which I have finished are so perfectly rendered that one can distinguish between twenty different persons, each one of whom has said a few words. One tremendous advantage is that the letter may be repeated a thousand times if necessary. The phonogram does not wear out by use. Moreover, it may be filed away for a hundred years and be ready the instant it is needed. If a man dictates his will to the phonograph there will be no disputing the authenticity of the document with those who knew the tones of his voice in life. The cost of making the phonogram will be scarcely more than the cost of ordinary letter paper. The machine will read out the letter or message at the same speed with which it was dictated. I have experimented with a device for enabling printers to set type directly from the dictation of the phonograph, and think that it will work to a charm. It is so arranged that the printer by touching a lever with his foot allows five or ten words of the phonogram to be sounded. If he is not satisfied with the first hearing, he can make it repeat the same words over and over again."

Litigation has broken out afresh in the old matter of the sale of the bankrupt Bankers and Merchants' Telegraph Company to Edward S. Stokes, representative of the United Lines Company. This time the lawyers are trying to find out what has become of 1,501 shares of Pacific Mutual stock and 395 shares of Board of Trade stock involved in the litigation, and which are said to be missing. The stock was placed some time ago, with the consent of the Farmers' Loan and Trust Company, in trust of Lawyer Edward Lauterbach, to be returned when asked for. It was asked for when Judge Barrett, in a suit brought by Townsend Cox against Edward Stokes, granted an injunction restraining the Farmers' Loan and Trust Company from disposing of any of the stock. Mr. Lauterbach said that he was pained to say that he was unable to find the stock anywhere. On the 19th inst. he went before Judge Barrett, and formally explained that by his own negligence the stock had been mislaid, and offered to give a bond to both the Board of Trade and the Mutual Pacific for the issue of new bonds in case the missing stock should be found after a fresh search for it. Judge Barrett said that the explanation was amply satisfactory, and ordered Stokes and his agents to deliver over to the Farmers' Loan and Trust Company, within ten days, either the old stock or new stock that should be issued to take its place.

The Tucker Electric Manufacturing Company have had the following orders recently for the Mather system: Paragon Silk mills, Paterson, N. J., 300 lamps of 16c.p.; Keasbey & Mattison's mills (chemicals), Ambler, Pa., 500 lamps of 16 c. p.; Tewksbury, Mass., Asylum, 500 lamps; Jacob New's silk mills, New York city, 50 lamps. E. P. Gleason & Co. are to furnish some very handsome shades of floral design—lilies, morning glories, etc.—for lights on and in the fountain at the Electrical Exhibition. The Tucker Company are also very busy on burglar alarm and bell work for hotels and private houses.

The Vitrite and Luminoid Company have just put on the market 100 volt 225-c. p. lamps for any system, in addition to their lamps of 6, 8, 10, 12, 16, 20 and 32 c. p., averaging from 3 to 4 volts per candle. They have also some lamps 54 ampère 110 volts. To their line of standard test instruments they have added some new current and potential indicators from R. E. Crompton & Co., of Chelmsford, England. A good demand is reported for the Cardew voltmeter. The company have also brought out some pretty colored bulb 20 volt 8 c. p. lamps.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Oct. 24, 1887.

Mr. W. E. Stow, formerly with the New England agency of the Sprague Electric Railway and Motor Company, and at present a member of the firm of Messrs. Kimball & Stow, of Fitchburg, Mass. (electrical engineers, etc.), was in Boston on a business visit last week.

Mr. George T. Manson, traveling representative of The Okonite Company, of New York, has been interviewing his many electrical friends and customers in Boston, devoting several days of the past week to that purpose. Mr. Manson favored this office with a visit.

Some time ago the Auxiliary Fire Alarm Company, of Boston, installed its system (already described in THE ELECTRICAL WORLD) in the Parker House. About a week ago, just after sunset, one of the hotel porters discovered smoke in heavy volumes coming from the basement and started for the push-button near by, which immediately gave alarm at the office of Captain Flanders, of the fire department, who quickly summoned several fire engines to the scene of the conflagration. Although the fire was burning briskly and spreading rapidly in the hotel basement when the firemen arrived, which, by the way, was only a few minutes from the time the porter gave the first alarm, it required but little time and labor to extinguish the flames; thereby saving from destruction one of Boston's most popular hotels. Messrs. Beckman & Punchard are enthusiastic in their endorsement of the "Auxiliary" fire alarm system.

The following item comes from an authentic source in Hyde Park, Mass.:

The Committee on Electric Lights held a meeting on Wednesday evening, Oct. 19. A communication was received from the American Electric Manufacturing Company, of New York, which set forth that the company was ready to sign the contract as prepared by the committee; or, in other words, the American company agrees to furnish arc lights of actual 2,000 candle power each. It is expected that the contract will be consummated at the next meeting of the committee, Tuesday evening, Oct. 25.

A dispatch from Woonsocket, R. I., under date of Oct. 19, states: "A number of the officials of the Thomson-Houston Electric Company, of Boston, witnessed the working of their electric car on the street railway to-day. The gearing and contact arrangements of the car have been much improved, and the car now runs smoothly and easily. The highest speed reached was 20 miles an hour. Regular trips will now be made."

Messrs. Sawyer & Blake, N. E. agents of the Sprague Electric Railway and Motor Company, report business in their line as being brisk, orders for the Sprague motor continually coming in.

The project for running an electric railway between the towns of Attleboro, North Attleboro and Wrentham, Mass., is a settled fact. A company has been organized composed of leading citizens of the towns named, and the capital stock is stated to be $100,000.

The French Cable Company gives notice that the lines of the Baltimore & Ohio Telegraph Company, having been purchased and now being operated in the interest of the Western Union, the public is advised to hand all cable messages intended for transmission via the French Atlantic cable to the Postal Telegraph Company. To insure transmission messages should be marked "via French," which is not charged for. The rate to Great Britain, Ireland and France is 12 cents, and to Germany 15 cents.

On Thursday evening, Oct. 20, at the Central Congregational Church, Jamaica Plain, Mass., Allan V. Garratt and Mary Charlotte Wilder were united in marriage by Rev. George M. Boynton, in the presence of a large assembly. Several members of the Boston Electric Club—of which body Mr. Garratt is the Secretary—attended the wedding and presented the happy couple with a handsome mantel clock.

The stockholders of the Schuyler Electric Company met last week in Middletown, Conn., and elected as directors John N. Camp, Henry Woodward, O. V. Coffin and Seth H. Butler, of Middletown; C. N. Wayland, New York; C. E. Dustin, of Hartford, and Frederick Fosdick, of Fitchburg, Mass.

Cards have been issued to the members of the Boston Electric Club requesting their presence at the next monthly meeting of that body at the club rooms, No. 66 Boylston street, on Saturday evening, Oct. 29.

The Electric Light Company, Winsted, Conn., has finished its dam at Robertsville Falls, with a tube or flume 250 feet long, with a fall of four feet to the 100, giving 200 horse-power. The building for the dynamos will be finished in a few weeks, and and it is expected that the machinery will be in operation before Jan. 1, 1888.

The annual meeting of the Edison Electric Illuminating Company, of Fall River, Mass., was held in that city on Monday, Oct. 17, and the following officers were elected: Clerk, Henry K. Braley; treasurer, Thomas R. Burrill; manager, Edwin S. Hammer; board of directors, Albert F. Dow, James B. Harley; Frank S. Stevens, Jerome C. Borden, James P. Hillard, Frank S. Hastings, Thomas R. Burrill, William S. Whitney. At a subsequent meeting of the directors, A. F. Dow was re-elected president. The directors declared a dividend of 2 per cent. for the last quarter.

The American Bell Telephone Company has just issued the following statement:

Month Oct. 20.	1887	1886.	Increase
Gross output	3,689	3,259	430
Instruments returned	2,213	1,745	468
Net output	1,476	1,514	Dec. 38
Since Dec. 20.	1886-87.	1885-86.	
Gross output	44,340	35,020	9,320
Instruments returned	22,028	16,413	5,615
Net output	22,312	18,607	3,705

Mr. F. A. Gilbert, the President of the Boston Electric Light Company, had an addition to his family recently in the shape of a fine 9-pound boy, whose card bears the name of "Harrison Ford." The fact is announced to Mr. and Mrs. Gilbert's many friends in a pretty little design representing the youngster as a "new trimmer," swinging along the circuit, from pole to pole, held up by a trolley. "Our latest idea" is certainly well carried out, and all will wish the young trimmer every happiness and success in life.

The "West End" electric car was given another trial in Cambridge, Mass., Saturday afternoon, and a party on board enjoyed a trip of about 1½ hours. Interested in the progress of the car, among others, were Superintendent Bancroft, assistant superintendents E. H. Littlefield and Harry Symonds, Mr. Granville D. Braman, treasurer of the West End Street Railway Company; Mr. Blake, of the firm of Sawyer & Blake, agents for the Sprague motor; Mr. James Ramsey and Mr. F. E Cobb, clerk Mr. H. M. Whitney. The car was in active operation about one hour and fifteen minutes, and during that time traversed about ten miles. A speed test was made on Kirkland street, and for about half a mile the car ran at a rate of between 10 and 12 miles per hour. From Harvard square to Barry's Corner, Brighton, a distance of over a mile, the running time of which for a horse car is seven minutes, the electric car covered in five minutes and forty seconds. The trial was one of the most successful which has yet been made.

The following item is from New Haven: "A problem which has taken two years of trouble and thought was solved on Tuesday by one of New Haven's young men named Julian F. Denison. A few months ago the *Morning News* told of his workings in a small room in the Cutler Building, surrounded by electrical appliances and mechanism, trying hard to improve the arc electric lamp. Young Denison has performed his task, and the lamp is hung in front of the office and shops of the New Haven Electric Light Company, on Temple street. The problem which Mr. Denison has solved is this: How can the electric lamps be so constructed as to do away with the necessity of supplying fresh carbons daily and take up less space? Mr. Denison put the problem to himself two years ago, and has been solving it since. His lamp is a marvel of mechanism. It is considerably shorter than the lamp in use, and is not as clumsy and bulky. It will hold a supply of 17 carbons, which will feed the light automatically and burn for about 100 hours. With the use of the light 12 hours per night, as at present, it will be seen that the lamp will burn for over eight nights. The lamp would only need "trimming" once a week. In addition the carbons are entirely consumed, thus saving much that is now wasted. In the change of the carbons 30 seconds are lost, during which time the light goes out. The big shade which covers the lamp now in use is also done away with. Mr. Denison has had a globe

made, cylindrical in shape, which meets the higher cup and fits so closely as to render damage by the elements out of the question, and there is no further use for the shade. Mr. Denison is but 21 years of age, and has never had a day's lesson in electricity. Out of pure love of science he has set about and accomplished his task." I understand that Mr. Denison is still pegging away at the subject, and will soon be building regular practical lamps.

Mr. James Swinburne, with Messrs. R. E. Crompton & Company, of London, England, the well-known author of the series of articles on electric measuring apparatus now running in the English *Electrical Review*, was in Boston on Thursday, Oct. 13. Mr. Swinburne was accompanied by Mr. Robert P. Sellon, an officer of the Anglo-American Brush Electric Light Company. These gentlemen visited a member of the "Hub's" electrical establishments; and at the invitation of the Thomson-Houston Electric Company they visited and were escorted over the large factories of that company at Lynn, Mass.

Prof. George Forbes, the scientist and the inventor of the Forbes coulomb meter for direct and alternating currents (see THE ELECTRICAL WORLD, Oct. 22, 1887), was in Boston on Saturday and Sunday, Oct. 15 and 16.

Mr. George Cutter, for 2¼ years past connected with the foreign office of the Thomson-Houston International Electric Company, returned to his home in Boston recently. While abroad Mr. Cutter was chief expert and traveling agent for Mr. James F. Meech, the European agent of the Thomson-Houston Company.

W. I. B.

PHILADELPHIA NOTES.

PHILADELPHIA, Oct. 24, 1887.

A meeting of the sub-committee on law of the City Councils was held last Friday afternoon, with Mr. Fow present, the author of the resolution instructing the City Solicitor to proceed at once to collect the bond of $50,000 given by the Baltimore & Ohio Telegraph Company to the city as a condition under which they were allowed to enter the city with their wires. The resolution also authorized the Department of Public Safety to take possession of the poles and wires of the company because the latter had violated the terms of the bond given in making a sale of its property or merging the franchise of the corporation with any competing line.

Mr. Walker, Chief of the Electrical Bureau, was asked by the chair whether the Baltimore & Ohio Telegraph Company had erected poles and wires under the ordinance granting the privilege by the city.

Mr. Walker—"They erected the wires and poles as authorized by Councils."

The Chair—"Then, Mr. Warwick," addressing the City Solicitor, "can we sue out the bond given by the company?"

City Solicitor Warwick—"The first thing to do is to ascertain whether the Baltimore & Ohio Telegraph has been sold, or whether there has been a consolidation or merging with any other corporation. That is the first thing for us to find out. We must know by evidence whether it was sold."

The bond was read, showing that the Baltimore & Ohio Telegraph Company bound itself in the sum of $50,000 in the event of any violation of the terms of the contract. It was signed by George French and Robert Garrett.

The chair suggested that nothing could be done but adjourn, and stated that all the parties concerned should be subpœnaed. With the understanding that Messrs. French, Garrett and others of the telegraph company should be subpœnaed to appear before the Committee at its next meeting, the Committee adjourned.

At an adjourned meeting held on Saturday, City Solicitor Warwick stated that to recover the $50,000 specified in the bond, it would be necessary to prove that the property and franchises of the corporation had been sold or merged with the Western Union. The sub-committee adjourned after giving instructions for the issuance of subpœnas to the bondsmen, George French and Robert W. Garrett, to appear at the next meeting. Since then it has been ascertained that Mr. Garrett has made arrangements for a winter trip to Mexico, and would start for the land of the Montezumas in a few days.

Chairman John H. Fow, of the sub-committee, who is diligently pressing for suit upon the forfeited bond, played a trump card by sending Sergeant-at-Arms Mortimer L. Johnson to Baltimore with a notice upon Mr. Garrett to be with the sub-committee at a meeting to be held Friday, Oct. 28. Mr. Garrett, may not come to the city, but the service of notice upon him will avoid delay in the prosecution of the suit by reason of his absence.

The subject of underground wires seems to be a never ending one with City Councils. There is hardly a meeting of one or the other of the branches of the city's legislature at which an ordinance is not introduced granting a privilege to some corporation to lay its wires under the streets, and they are always referred.

The Graves Electric Meter Company have opened an office at No. 1,406 Chestnut street, where they have two of their meters in operation connected with quite a number of incandescent lamps. Very little has as yet been done toward introducing this very useful invention on the market, as the company has not yet been thoroughly organized, and is not yet in a position to manufacture. The instrument is a model of simplicity, consisting of very little more than a portion of a clock movement, a train of dials, such as are used on an ordinary gas meter, and a mainspring which will, when wound, last for thirty days, and which is held in check by the clock wheels, the latter acting as a "governor." The instrument is connected with each lamp separately, and can be made to accommodate almost any number desired, and, as it is cut in or out by simply turning the button which puts the lamp in circuit, there is little or no chance of its getting out of order or requiring any other attention than an inspection once a month. Prof. Carl Hering, Superintendent Law, of the Brush Electric Light Company, and many other prominent electricians, have made careful examinations of the machine, and speak well of it. Mr. Hillman, who is one of the promoters, and who is in charge of the company's office, expects that within the course of a week or two they will be ready for business, and as there is no doubt of the practicability and efficiency of the meter, it is fair to presume that its introduction will largely increase the use of both arc and incandescent lighting, as by this means it will be made possible for the electric light companies to regulate their rates in proportion to the amount of light consumed. The absence of this feature has, it is believed, deterred many people from using electricity for lighting purposes where the consumption would be comparatively small, but with no means of ascertaining the exact amount of light used they would be compelled to pay the same price as though they used the maximum amount furnished.

The meeting in this city of the convention of the American Street Railway Association for two days last week has given fresh impetus to the agitation of the subject of electricity as a motive power for street railroads, and the subject having been thoroughly discussed in all its features, will undoubtedly receive much more attention by street car companies than it has heretofore had. Nearly all of the 154 companies which compose the membership of the association were represented, and the sessions lasted two days. On Wednesday Mr. Wm. Wharton, Jr., of this city, president of the Cape May and Schellinger's Landing Railroad Company, read a very interesting paper on "Electricity as a Motive Power," and at its conclusion was interrogated very freely by many of the members, who are giving the question careful and earnest consideration. Mr. Wharton set forth very fully and lucidly the advantages of electricity as a propulsive force over horses and other systems, and he estimated the total cost of the storage battery motors to be much less per day than horse cars, and on the basis that three of these electric cars could do the work of four horse cars. He produced a forcible impression in favor of electric cars and concluded by inviting all of those present to take a ride on one of his company's cars, which was accepted by a large number. During the evenings of both days of the sessions the car was brought out and trips were made over the Chestnut and Walnut street line, much to the delight of those who enjoyed it, and on each run the car was crowded to the extent of its capacity. On Thursday the discussion of electric motors occupied a good portion of the session, and many of the delegates whose knowledge of the question had been rather limited left with very favorable impressions as to the efficiency and economy of the future motive power.

Mr. Mansfield, of Boston, a man of very large experience in electrical motors, who arrived here a day late, was accorded permission to speak on the subject, and stated that the electric motor could be guaranteed to operate at 30 per cent. less cost than the cable method.

John Edward Kelly, manufacturer of speaking tubes and the Globe acoustic telephones, has removed his manufactory from Camden, N. J., to Lock Haven, Pa. These telephones are for offices, warehouses, mills and factories, and are cheap and convenient.

In reference to the "dynamograph," which is now brought to a state of perfection in this city, the following dispatch to the Baltimore *Sun* from its Washington correspondent will probably be read with interest:

"There is considerable talk in the Patent Office just now concerning an invention patented recently, which, in the opinion of some, will be a formidable rival of the telephone, Mr. Bell's monopoly. The invention is an electric type-writer. The instrument in appearance somewhat resembles an ordinary mechanical type-writer. It has a key-board, and the types are placed on steel bars, which play upon a common centre, as is the case with the type-writer. The motive power used is electricity, by means of which evenness of action is assured. No matter how heavily or how lightly the keys are struck, the impression on the paper is the same. A remarkable feature of the invention used as a type-writer is that the carriage moves automatically both forward and backward. When the end of the line is reached the carriage returns to the starting point without the aid of the operator, and the paper bar moves one notch, so that all that is required of the operator is to depress the keys. The most important field for the new invention is said to be in connection with the telegraph. It is said at the Patent Office that the instrument can be used both as a transmitter and receiver of intelligence over a single wire, no matter how great the distance may be. The receiving instrument does not require the attendance of an operator, but prints the dispatch automatically. The instruments at both ends of the line print the dispatch sent, and so a safeguard against mistakes is provided. It is claimed that the electric type-writer will be valuable as a local aid to business, and offers many advantages over the telephone. One advantage claimed for it is that no matter whether a person called up is at his place of business or not, the message can be printed through the medium of his type-writer, and will be there for perusal on his return. The dispatches printed are in letter form, and not an endless tape. The instrument, which has been christened the dynamograph, is considered by patent office officials to be one of the greatest inventions upon which patents have been issued. The electricians do not stint their praise, and are positive that the machine will greatly simplify business intercommunication. Some of the electricians of this city who have seen the instrument, notably Professor Berliner, of the Bell Telephone Company, state that the dynamograph is destined to take its place as a powerful adjunct to telegraphy, and will be by no means a rival that the telephone can afford to scorn. John Russell Young, ex-Minister to China, has taken hold of the new invention, and is president of the company which is to put it into practical operation."

A despatch from Belvidere, N. J., says: "The Belvidere Gas and Electric Light Company has purchased the entire plant, machinery and poles necessary for lighting the town by electricity. The matter of electric lighting was agitated about six months ago, and had apparently died out. The work will be begun at once, and the good people of the town congratulate themselves on the happy prospect of having well-lighted streets."

E.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, Oct. 22, 1887.

I am informed that a syndicate of Chicago capitalists will shortly be formed for the purpose of joining certain territory under a franchise from the Electrical Accumulator Company, of New York. This syndicate will purchase the rights already held by Messrs. Johnson, Holland & Co., and will control the States of Illinois, Wisconsin, Minnesota and the counties in Iowa bordering on the Mississippi River. Mr. C. N. Fay will probably be president of the new company. Capital stock will be in the neighborhood of $250,000. It will be seen from the foregoing that active measures will be commenced shortly for placing these batteries properly on the market in the West.

The Butz Thermo-Electrical Regulator Company have received notice, officially, of the acceptance of their device by the Pullman Palace Car Company for regulating the temperature in the cars manufactured by this company. This regulator was described in a recent issue of the WORLD. Mr. Butz is to be congratulated upon securing so high a recommendation as the Pullman Company's indorsement will give it.

The Chicago Raw Hide Manufacturing Company, at 75 and 77 Ohio street, have called my attention to the merits of the belt of their manufacture, and solicit inspection and trial by the electric light interest. By inquiry I find that this company furnished the first belt used upon a dynamo in this city, which I am told is still in use. The belt which they sold for Willoughby & Hill's electric light plant four years ago is still in good condition. This company recently received orders for belts for electric lighting purposes from Nashville, Tenn., and Los Angeles, Cal., and from Crane Bros., of this city. This company use the raw hide, which they preserve by a patented process, and which they claim is of great durability under all conditions. Belts are spliced by using raw-hide thongs, so that no foreign matter or substance enters into their manufacture.

Vilas Bros., Quincy and Fifth avenues, announce that they have perfected a dynamo oil, for which they claim many good points.

I note the following incorporations:

Illinois Woolley Electric Motor Company, of Chicago; capital stock, $100,000; object, manufacture of magneto-electrical engines; incorporators, Clair D. Vallette, Albert N. Eastman and Edward E. Gray.

Brookline Electric Motor and Lighting Company, of Chicago; capital stock, $100,000; object, to furnish electrical power, electric light, etc.; incorporators, William A. Stiles, Jas. McLaughlin, John R. Hollister.

The *Daily News* of this city, seemingly anxious to keep the days of telephone speculation in the recollections of the public, published last week an article substantially the same that they have published nearly every year for the past four years, giving the names of several gentlemen who made fortunes out of the rise in telephone stock. Two or three of the Aldermen in the City Council are determined to tax the telephone company, and have seemed to be devoting a great deal of their time in getting together evidence for presentation before the Council Committee. One of the most active members of the Council in opposition to the telephone rates paid THE ELECTRICAL WORLD's representative a call this week, and, acting on the supposition that he was not recognized, propounded a series of questions with the evident object of securing information to be used in fighting the telephone company in Council. I do not believe, however, the tax which will probably be imposed will have any appreciable effect upon the revenue of the company.

My correspondent at St. Paul states that the electric light interests in the Northwest are growing very rapidly, and the outlook for the future is most promising. The gas company at St. Paul are enlarging their electric light plant. The Eureka Improvement Company are hard at work upon their electric light plant. They will use the Thomson-Houston arc system and the Westinghouse system for incandescent lights. Their current will be used for running the electric motor for the Enos Electric Railway, of which there is about one mile now completed, and which they expect to have in operation by Jan. 1. Your readers will remember that in this electric railway, cars are suspended from the top. Like a great many other new devices this has its adherents, besides those who view the arrangement unfavorably.

A dispatch from Laredo, Tex., of Oct. 4, says: The Western Union wires out of this city to San Antonio were cut in this county near Encinal, and were not repaired until late yesterday morning. No cause can be ascertained for the deed. It leaks out that the Western Union Telegraph Company and the Mexican National, who own their own lines to Corpus Christi, have made arrangements by which the first named company are to construct a line upon the latter's poles to Corpus Christi. The line will, when constructed, partially do away with the line now running from Corpus Christi to Houston and Brownsville, and Mexican business now coming in through Matamoros can then come via Laredo, thence to San Antonio, securing an outlet of that line. Mr. L. E. Baker, general superintendent of the Western Union at St. Louis, is expected here in a day or two.

It seems almost certain that the Council will do something soon looking to the establishment of an electric light system for the city. "It is the only way out of this trouble," said City Clerk Nickerson a day or two ago. "It solves this gas problem so far as the city is concerned, and it is the only thing that will. There is no use in talking, the city should own and control its own system for supplying light, the same as water, and not be at the mercy of any gas monopoly. The interest manifested by many Aldermen proves that they think the same thing." Yesterday Alderman Gile talked with Mr. Barrett to see if he couldn't offer some solution of the problem. The professor gave the Alderman many facts and figures. Alderman Kerr also favors the electric light system, as do Clarke, Hamline, Wetherell, Manierre, and many others. To give the aldermen more accurate information, Mr. Barrett is having careful estimates made for all parts of the city, and will soon be able to tell the Council just what electricity will cost and what it can do.

The United States Electric Light Company, of St. Paul, of which Mr. J. H. Woolsey is agent, states that a company will be incorporated shortly for putting in incandescent light plants of the alternating system, with a capacity for 3,000 lights. The Westinghouse people state that if the United States people attempt to use the alternating system suit will be brought. Mr. Woolsey also states that his system will be used for central station purposes at Stillwater, Minn.

The Sawyer-Man plant in the Portland block is almost completed. Its capacity will be for 800 lights. My correspondent states that the Mather system is very much in favor in Minneapolis and that the plant in the Opera-House in that place is giving the greatest satisfaction.

The Edison Electric Light and Power Company, of St. Paul, are doing a large central station business. They have now about 8,000 lights running and orders are increasing daily. They have

secured the contract for wiring the new Court-House for 1,600 lamps. There is some talk of using electricity instead of cable for the street railway of St. Paul. The cable line is almost finished, and if they decide upon motors it will be done very shortly.

My correspondent at Salt Lake City informs me that the Rocky Mountain Bell Telephone Company declared a dividend of 1 per cent., payable Oct. 15. At the last meeting of the City Council the agent of the Electric Street Railway Company appeared before the Committee on Streets and Alleys to explain the method of operating the electric street railway system, which in this case will be the Sprague. Overhead conductors will be used. The feature of the petitioner's remarks was the statement that if a car jumps the track not over three feet, that there is sufficient force in the current to pull it back on the rails. The committee is expected to report shortly.

The regular meeting of the Chicago Electric Club was held Monday evening at 122 South Clark street, where rooms have been selected for the permanent accommodation of the club.

The apartments selected are in every way suitable for the society, and it is expected that increasing interest will follow, now that conveniences have been provided. Vice-President C. A. Brown occupied the chair. The evening's paper was read by Mr. E. P. Warner, entitled "Automatic Current Regulation." The discussion which followed was participated in by Mr. Sperry and Mr. Badt. A vote of thanks was tendered Mr. Warner. The attendance was larger than at any previous business meeting.

One of the good points embodied in the Edison plant in the Phœnix Building, of this city, is the Baragwanath steam jacket feed-water boiler and purifier, manufactured by Wm. Baragwanath & Son, 48-52 W. Division street. This water heater has attained the highest reputation among practical engine men. The feature of this heater is the high temperature at which the water is kept. They claim a saving of from 10 to 40 per cent. in coal consumption. I have taken the time to ascertain the estimation in which this heater is held and am warranted in stating that the testimonials which are published in their catalogue do not adequately describe the satisfaction which their customers express by word of mouth.

My New Orleans correspondent sends me the following:

The acquirement of the Baltimore & Ohio system by the Western Union Company has revived here the proposition to establish a government service. The *Times-Democrat* Washington correspondent has been interviewing senators and representatives on the subject and finds feeling to be generally in favor of some such course. Only a few weeks ago, he says, when a financial panic was reported to be impending, the Secretary of the Treasury was absent from the city and it was important that he should be communicated with immediately. The telegraph was the only means of prompt and speedy communication, yet the Treasury officials were afraid to use it, apprehending that the information desired might leak into the stock market and be misconstrued. Such a state of affairs should not exist, and the only remedy seems to be to establish a government line. Many of the prominent officials of the government heartily approve the establishment of such a line, and at the Post Office Department it is said that the Postmaster General may, in his annual report, recommend the establishment of a telegraph system to be conducted in connection with the postal service.

A number of accidents have been reported here lately in connection with electric light wires, and the papers have called for greater care in wiring. In one case a lineman was killed a few days ago, and there have been instances within a day or two of mules and men being shocked by loose wires. There were also some small fires. It looks as though some careless work had been done in wiring, due, it seems, to the hurry in installing the new alternating system, though from the lack of details it is not quite clear what the origin of the trouble is.

The *Times-Democrat* has the following from Chattanooga: One of the most striking instances of the metropolitan aspect that Chattanooga is fast assuming is the improvement in lighting. Here, too, electricity has said that other lights must take a back seat. A glance at the lights in the Union Depot and other buildings was like meeting an old friend. The soft incandescent light was unmistakable; it was the celebrated Westinghouse system so successfully tried in New Orleans, which fills the bill in the *Times-Democrat* office, and illuminates the Pickwick and prominent clubs. Some time ago the Brush Electric Light Company of Chattanooga decided to go into the business of incandescent lighting, and having examined all systems did exactly what the Brush Company of New Orleans did—adopted the Westinghouse system.

The agent of the Western Electric Company at St. Paul is doing a large business in mercurial fire-alarms and hotel work. An ordinance was passed by the City Council granting the Eureka Improvement Company the privilege of maintaining poles and wires in West St. Paul for furnishing electric light and power.

The demand for electric appliances in the Northwest is unprecedented and supply companies cannot furnish goods fast enough to supply the trade.

A flouring mill is to be constructed at Laramie, Wyoming Territory, of four floors, power to be furnished by two 50 horse-power Sprague motors.

The following interesting item as to the Midland Electric Company is from the Omaha *Bee* of Oct. 9:

This popular firm have removed from 1304 Douglas street and can now be found at 1213 Harney street. Their new quarters have been fitted up expressly for the accommodation of their business and the convenience of their employés. Their office is supplied with facilities for exhibiting to their customers the actual workings of the different apparatus supplied by them. They are now better prepared than ever to supply churches, opera-houses, banks, hotels and private houses with fire and burglar alarms, annunciators, etc. They also fit public and private buildings with electric gas-lighting apparatus. This company have the exclusive right for the Western States for the only perfect system of district telegraph known as the McCulloch system. They wish to call the especial attention of hotel keepers to their new system of fire-alarm and room call, which enables the clerk to call all of the guests of a hotel at a moment's warning in case of fire, or to arouse any individual for an early train without disturbing others. Their business extends as far west as Portland, Ore. Among the many contracts for electric work of different kinds secured by them the following may be mentioned as showing the people who patronize them: The new Pacific Hotel at Norfolk, Neb.; the Newton House at Central City; the Touzalin House at Wymore, Neb.; Hotel Esmond and Barker Hotel, of this city; the private palatial residence of J. J. Imhoff, of Lincoln, Neb., which in point of electrical fittings surpasses any home west of Chicago. In Omaha they have fitted up something over twenty fine residences in Kountze place, among them those of Dr. Peabody, T. F. Rogers, C. S. Montgomery, W. G. Albright, D. V. Sholes, Moritz Meyer, Louis Bredford, Ellis L. Bierbower, J. H. Millard. They are prepared to do all kinds of shop work and repairing. Those contemplating electric apparatus of any kind in their house cannot do better than to call on or correspond with the Midland Electric Company, 1213 Harney street. One of their specialties not mentioned above is the fitting up of speaking tubes, having put in what would aggregate some seven or eight thousand feet within the past year in Omaha.

The first young lady to be cremated in America was 9-year-old Alida Weissleder, the daughter of the superintendent of the Brush Electric Light Company in Cincinnati. Her body was burned last week at the crematory in that city. The corpse, wrapped in white alum linen, with white and yellow roses on the breast, was slid into the retort by two attendants, who at once retired, and in the stillness that followed the mourners could hear the puff and sizzle of the gases of the body as the heat devoured it. After an hour the blue flames stopped circling about the body, and a long white streak was seen where it had been. These ashes, when gathered up, weighed less than a pound. They were returned to the parents, and will be preserved in an urn. It was the ninth incineration at the crematory.

Col. S. G. Lynch, broker, 146 La Salle street, Chicago, furnishes me with the following quotations upon telephone stock:

	C. H. M.
Bell of Mo.	$155@$157
Central Union	44@ 45
Chicago	375@ 390
Colorado	18@ 20
Cumberland	80@ 85
Great Southern	28@ 30
Iowa Union	25@ 27
Michigan	73@ 74
Missouri and Kansas	69@ 70
Rocky Mountain Bell	40@ 45
Wisconsin	105@ 107

DETROIT, Mich., Oct. 11, 1887.

This city can, without extravagant boasting, lay claim to being one of the most advanced cities in the world in the use of electric light. In Milan, Paris and some European cities electric light is, or will be, used exclusively in theatres, halls, etc., but this condition of affairs has been the result of compulsory legislation. In Detroit all of the theatres, four in number, are lighted from the Edison station, and this result is reached not by compulsory legislation but rather through the enterprise of the theatrical managers here, who, having some of the finest opera houses in the country, cannot afford to be behind the day on so important a subject as lighting. The entire city lighting is done by the Brush Company, which boasts of one of the finest and largest plants in the United States, while the principal business houses, hotels, theatres and manufacturing establishments are lighted by the Edison incandescent. The Edison Company have lately wired up for 1,000 lights the mammoth warehouse of D. M. Terry & Co., the seedsmen, which covers nine acres of floor space; the Russell House with 350 lights; the new Y. M. C. A. building with 300 lights; the Detroit Opera House, 600 lights; Whitney Opera House, 400 lights; the Detroit Public Library, 200 lights; the Casino Theatre, 150 lights; the Calvert Lithographing Company, 200 lights; the Detroit & Cleveland Steam Navigation Company, 100 lights; the police headquarters with 150 lights, and a large number of smaller customers, aggregating in all about 4,000 lights added since July 1, 1887. The station is now carrying nearly 10,000 incandescent lights and is also the largest Edison station in the United States, save the Pearl street station in New York city.

MONTICELLO, Minn., Oct. 7, 1887.

At Mankato, in this State, a Heisler long-distance incandescent plant of 160 30 c. p. capacity has been in operation successfully since the middle of August. The plant was sold and put in by Mr. W. F. Brown, the Heisler Company's agent, and is giving very much satisfaction—except, possibly, among the gas people there. The circuits cover nearly ten miles of street, and the lights at the farthest point from the station are equally as bright as the pilot lamp over the dynamo. The 9 × 14 Russell automatic engine used is giving excellent results.

The plant of the Fergus Falls Electric Light and Power Company, Fergus Falls, also in this State, started up on the night of Sept. 27, with 150 30 c. p. lights in circuit, reaching a paying basis on the very start. The plant was put in under the supervision of Mr. W. F. Brown, of Monticello, Minn., who is the State Agent for the Heisler Company, and although, when he reached town, only one week previous, not a single light had been engaged nor a wire run, nor the circuits planned even, the work was rushed through without a single mishap, and the lights were started at the time set.

The local paper, which, by the way, is owned by some of the gas people there, in speaking of the success, said: "According to promise, the electric light engine and dynamo were set in motion Tuesday evening, and after some tests were made at the station the full current of electricity was turned on, and the stores all over the city were illuminated with the new light, which is all that had been claimed for it, and the customers are universally pleased. A number of additional applications have already been received, and it looks now as if *kerosene* would pretty nearly go out of use in the business part of Fergus Falls. The merchants are very generally discarding it and taking electric lights instead."

The paper doesn't mention its effect on the consumption of gas, though outsiders predict that the gas company will have to make some change in consequence. The station is situated on a siding of the Northern Pacific Railroad, where coal may be landed at the furnace door with the lowest possible expense. Brick foundations have been put in for two dynamos of 170 30 c. p. light capacity each. A 10 × 14 Buckeye engine is used, together with a Brownell boiler with U. S. rocking grates, Blake pump and Robinson heater, the whole steam outfit being furnished and set up by Robinson & Cary, of St. Paul. Enough lights have already been engaged in stores, churches and residences to tax the second dynamo, which is soon to arrive.

THE TELEGRAPH.

Western Union Guaranteed Securities.—A curious feature about the Western Union report is that no mention is made of the scheme voted on last April to issue bonds to take up some $35,000,000 of guaranteed securities.

A Neat Gift.—Telegraphers connected with the Baltimore & Ohio Company met on Oct. 22 and formed the Phœnix Electrical and Social Club. C. W. Price, formerly superintendent, was presented with a locket appropriately inscribed and adorned with a diamond, the gift of his associates.

United Lines.—It is understood that the business of the United Lines Telegraph Company has increased heavily since the sale of the Baltimore & Ohio to Western Union. The company has some 35,000 miles of wire, made four times its length between important centres by the quadruplex system.—*Boston Herald.*

Heavy Damages.—The jury in the case of Jerome Staring against the Western Union Telegraph Company, brought at Elmira, N. Y., to recover $20,000 damages, gave a verdict for $9,000 last week for injuries sustained by plaintiff being thrown from his wagon, when his horse was frightened by employés of the company, who were at work taking down a wire.

The Direct Cable.—A special dispatch from Halifax, N. S., of Oct. 20, says: The steamer Britannia, from Tor Bay, arrived here to-day, having made a connection with the direct cable from that place to this port, which is hereafter to be the terminus. The end of the cable was buoyed at the mouth of the harbor to wait the completion of arrangement for its landing. It is to be landed at a lumber yard and brought up under ground to the centre of the city.

The Cable War.—A cablegram of Oct. 20 from London says: "The Atlantic Cable war is by no means at an end, to judge by statements made by Mr. De Castro, a director in Europe of the Commercial Cable Company. Messrs. Mackay and Bennett mean to continue the fight, and they refuse to be bought up by the pool. Some months ago they were prepared to make some concessions provided that rates should never exceed 1s. 8d., but now that they have been reduced to 6d., and they get a still greater support from the public, they will take no steps with a view of shortening the war. The 1s. 8d. rate is the maximum to to which the Commercial Company will go, but it is the belief of Mr. De Castro that 1s. per word will be the rate of the future."

B. & O. Figures.—Dr. Norvin Green stated on Oct. 17 that he had received from Mr. Bates, of the Baltimore & Ohio Telegraph Company, a statement of the business of that company for the last year. The company's total receipts were for the fiscal year ended on Sept. 30, $2,983,506. Mr. Bates estimated that the Western Union Company could retain $1,500,000 of that business at an expense of less than $500,000 per annum. The Baltimore & Ohio received and sent 7,500,000 messages during the past fiscal year, as against 47,300,000 of the Western Union. The actual mileage transferred by the Baltimore & Ohio is as follows: Owned, 52,603 miles; leased, 1,504; controlled, 4,480. The number of offices taken is over 1,000, about 250 of which were not duplicated by the Western Union.

Raising the Rates.—Orders have been sent out to the old Baltimore & Ohio offices to make their rates conform with the Western Union rates. This is claimed by the Western Union not to be an increase in rates at all, as the old rates of the Western Union have not been changed, and only such rates on the Baltimore & Ohio as were either greater or less than Western Union rates to the same points have been changed to conform with the main company's tariff. As an instance, the Western Union rate from New York to Chicago was 50 cents, and has been for a long time, but the Baltimore & Ohio had a cut rate of 15 cents for the same service, which the first company would not meet. Under the new order the rate has been made to conform with the Western Union schedule, and hereafter 50 cents will be the charge.

New West Indian Cables.—The Western Union's cable business to the West Indies is likely to be affected by the laying of new lines by the Commercial and French Cable companies, acting together. The French Government has granted a concession to the French company for a cable connecting Brazil, Central America, the Antilles and New York, and 15,000,000 francs is reported to have been subscribed for it by a syndicate including the Crédit Foncier, the Comptoir d'Escompte and the Transatlantic Bank. Work on the new lines is to be begun immediately. A land line will connect New York and Charleston, from which city a cable will be laid to Havana. From Havana another will go to Hayti or San Domingo, thence to Guadaloupe or Martinique and thence to French Guiana, where connections will be made with the Brazilian land lines for Rio, Pernambuco and other South American points. A short cable will be laid between San Domingo and Jamaica, connecting with the system now existing in Central America and along the western coast of South America. The new lines will at once come into rivalry with the Western Union in the West Indies, where that company has had things pretty much its own way for the last 15 years. They will also cause a considerable cut in the rates to Rio, now reached by cables by England and Spain.

THE TELEPHONE.

Nashville, Tenn.—The old telephone rates have been restored at Nashville.

West Virginia.—The Glenville & Weston Telephone Company has been incorporated by S. B. Brown, J. S. Brannon, W. I. Wiant and others, with a capital stock of $10,000.

Erie Dividend.—Contrary to expectation and to the new programme as announced, Erie telephone directors have declared a dividend of ¾ per cent. ($36,000) for payment Nov. 14 to stock of Oct. 31.

Telephonic Investigation.—The Ainsworth telephone in

vestigation committee met at Buffalo on Oct. 20 and went into the affairs of the Buffalo company. The committee is to meet in New York on Nov. 10.

Arkansas Infringers.—The American Bell Telephone Company has made arrangements to institute a suit against the last of the principal infringers of their patent—those operating in the State of Arkansas, in the cities of Little Rock, Fort Smith, Van Buren and other points.

For an Indian Prince.—The Maharajah Sir Waghee, of India, has, it is stated, bought $25,000 worth of material in this country for a telephone service and an electric light plant, to be established when he gets back home.

The National Secret Telephone.—Judge Donohue has appointed J. F. Wagner receiver of the National Secret Telephone Company, on the application of Margaret P. Valentine. The company was incorporated in April, 1882, with an authorized capital of $5,000,000, to operate the telephone of Prof. J. Harris Rogers.

The West of England.—Mr. H. F. Lewis, the general manager of the Western Counties & South Wales Telephone Company, Limited, has now put the toll system in operation between Bristol, Bath, Gloucester, Newport, Cardiff, Pontypridd, Swansea, Llanelly, Landore, Morriston, Neath and Briton Ferry. The tolls are to be collected monthly from subscribers using the service.

The Emmner Telephone.—Mr. J. Emmner, Jr., of the Emmner Improved Telephone Company, of Washington, writes us: "In reference to the Mix-Genest microphone, an account of which you published in your issue of Oct. 1, I would say that said microphone is a direct infringement on one of our patents. The brake or damper, as also the regulating device, is broadly covered by our claims, and has been in use in our system for over one year; consequently it cannot be a new device credited to Mix and Genest."

The Wire Cutter Indicted.—George Addy, a wealthy resident of Paterson, N. J., was arraigned on Oct. 22 in the Court of Quarter Sessions on two indictments charging him with malicious mischief, the mischief consisting in cutting the wires of the New Jersey & New York Telephone Company and the wires of the Patterson fire-alarm telegraph. These wires ran in front of property owned by Addy and he objected to them. He pleaded not guilty, and Thurday of this week was fixed for the trial.

Thirty-Seven Suits.—A special dispatch from Indianapolis of Oct. 15 says: The American Bell Telephone Company and the Central Union Telephone Company brought 37 suits in the United States Court here to-day against 51 patrons of the Cushman Telephone Exchange at Elkhart, Ind., alleging infringement of the Bell patents, and asking judgment for damages and costs and injunction against the further use of Cushman instruments. These suits are similar to those brought a few weeks ago against the use of Cushman telephones at Laporte, where the toll system of the Central Union was suppressed and a Cushman Exchange established. The Central Union and the Cushman are both operating in Elkhart, and South Bend is without a telephone exchange, the poles and wires of the Central Union having been cut by the Street Commissioners while its toll system was in operation with a limited number of stations.

THE ELECTRIC LIGHT.

Weston, W. Va., is desirous of having an electric light plant.

Reno, Nev.—The Reno Gas Light Company is to put in an electric light plant.

Ballston, N. Y.—Mr. W. K. Freeman is to erect an electric light plant at Ballston.

Bowling Green, Ky.—The City Council have decided in favor of putting up an electric light plant.

Portsmouth, N. H.—The new Thomson-Houston plant will be in operation in Portsmouth in about five weeks.

Columbia, S. C.—An electric light plant has been put in by the Southern Cotton Oil Company in its oil mill.

Hudson, Wis.—Mr. S. H. Pierce, the owner of the plant at Hudson, has made an offer to light the principal streets.

Westerly, R. I.—The Westerly Electric Light Company will erect a plant. A. B. Chace and A. Perry are interested.

Concord, N. C.—A company with a capital stock approximating $10,000 is expected to put up a plant at Concord.

Spokane Falls, Wy. Ter., will, it is stated, have a plant comprising a large number of arcs and 1,800 incandescents.

St. Albans, Vt.—The Thomson-Houston Electric Light Company, of St. Albans, Vt., has just ordered a Ball 13 x 12 engine.

Austin, Tenn.—Mr. S. Watts and others propose to build gas, water and electric light works, and have asked for a permit.

Troy, N. Y.—The Edison Company has a contract for lighting and heating the Union Depot at Troy. The cost is put at $30,000.

The Lester Carbon Company, of Cleveland, O., has been incorporated by C. G. Howard and others, with a capital stock of $100,000.

Columbus, Ga.—Permission to put up an electric light plant has been asked for by T. E. Blanchard, A. Dexter, E. H. Jenkins and others.

Lima, O.—The Silvey Electric Company, of Lima, O., has been incorporated by E. P. Graf and others, with a capital stock of $50,000.

Mexico, N. Y.—The Mexico Electric Light and Power Company, recently incorporated by W. H. Weed and others, has a capital stock of $8,000.

Mauch Chunk, Pa.—The Mauch Chunk Electric Light Company has been incorporated, with a capital stock of $1,500, by H. W. McClure and others.

New York City.—The Edison Electric Illuminating Company has filed plans for a $200,000 building at Nos. 117 and 119 West Thirty-ninth street.

Plainfield, N. J., has renewed for twelve months its lighting contract with the local Westinghouse Company, and it is reported that incandescents are to be used on the streets for public lighting.

Chicago, Ill.—The Electric Gas Light Company, of Chicago, Ill., has been incorporated by W. W. Smith and others, with a capital stock of $100,000.

St. Cloud, Minn.—The Gem Electric Light Company has been formed at St. Cloud by H. C. Metzel, M. Moliter and others and is asking for a franchise.

York, Neb.—The York Gas and Electric Light Company, of York, Neb., are contemplating increasing their plant, and have just ordered a 10 by 12 Ball engine.

Kankakee, Ill.—The Kankakee Electric Company recently formed by W. S. Reed, J. H. Seaver and others has a capital stock of $10,000. It is to do a light and power business.

St. Albans, Vt.—An electric light company has been organized in St. Albans, and the stores and streets of that village will soon be lighted by arc and incandescent lamps.—*Boston Jour. Com.*

Oneonta, N. Y.—The Oneonta Electric Light and Power Company is to put in an American arc plant of 50 lights and a Westinghouse alternating plant of 650 lights. It hopes to be running before Dec. 1.

The Jenney Electric Company, of Indianapolis, has just put in a 20 arc light plant for Haugh, Ketcham & Company, of Indianapolis, and has sold a 60 arc light plant to the city authorities of Bowling Green, Ky.

Allentown, Pa.—The Councils of Allentown, Pa., have voted that during the next five years the streets of Allentown shall be lighted with ninety-eight electric lights, and 125 naphtha lamps, at a total cost of $11,975 per annum.

Change of Name.—The name of the Brush Electric Light and Power Company, of Nashville, Tenn., will hereafter be the Nashville Light and Power Company.

Scranton, Pa.—The Scranton Illuminating, Heat and Power Company, of Scranton, has ordered a 60-arc light outfit from the Western Electric Company, of Chicago.

Western Electric Company's Plants.—The Western Electric plants at Kankakee, Ill., and East Liverpool, O., have each been increased by a 40-light dynamo.

Los Guilicos, Cal.—The Los Guilicos Water, Light and Improvement Company has been incorporated with a capital stock of $250,000, by J. M. Donohue, N. W. Griswold, A. S. Rohrer and others, and has obtained gas and electric light franchises.

Carrollton, N. Y.—A Brush-Swan lighting plant is being placed in the large kindling-wood factory of Blaisdell Bros., at Carrollton, N. Y. This enterprising firm have also contracted for a similar plant to be placed in their new factory at Austin, Pa.

Buffalo, N. Y.—The electric light companies at Buffalo have published a strong manifesto pointing out the many advantages of the electric light for city purposes, and shows too that there has been a marked, though indirect, benefit to the public in the reduction of the price of gas.

St. Louis, Mo.—The Pike Electric Company, recently organized, as noted before, is handling the Cleveland motor, and is making a specialty of the supply of arc and incandescent plants. Mr. E. W. Pike is president, Mr. N. O. Gray treasurer, and Mr. S. B. Pike secretary and manager.

Macon, Ga.—The Jeter and Boardman Water and Gas Association has been formed at Macon by W. A. Jeter, of Brunswick, Ga.; J. S. Schofield, A. D. Schofield, A. E. Boardman, J. W. Wilcox, and J. H. Campbell, all of Macon, to build and operate gas, water, or electric light plants. The capital stock is $50,000.

Sprague, Wash. Ter.—The Sprague Electric Light Company was organized recently by G. S. Brooke, J. J. Burns, W. H. Shields, W. B. Lotman and D. K. McPherson. The last named is president and Mr. Lotman is secretary. The company is now investigating the merits of various systems prior to deciding on the nature of its plant.

Roanoke City, Va.—Bids for the erection of an electric light plant were opened at Roanoke City, Va., by J. T. Engleby, chairman of the light committee, on Oct. 10, as follows: American Electric Light Company, Nashville, Tenn., $18,550; Thomson-Houston Electric Light Company, Boston, Mass., $22,125; Cecil P. Poole, Lynchburg, Va., $26,200.

Worthville, N. C.—The United States Electric Lighting Company have just put in a 200 light incandescent plant for the John M. Worth Manufacturing Company. The plant includes a 27 h. p. Westinghouse engine. Mr. T. C. Worth says: "We are very much pleased with the careful, neat manner in which all details have been finished in connection with the work."

The American System.—Although it is less than a year and a half since the American system as now constituted was first introduced by the American Company, it is claimed there are over 10,000 arc lights of that manufacture in daily operation. It is thought by the officers of the American Company that their output during the present year will exceed 15,000.

Middletown, Conn.—Citizens of Middletown have subscribed for $50,000 worth of the Schuyler Electric Light Company's stock (of Hartford), on condition that the company will move to Middletown, and it is probable that the arrangement will be made. If so, the company will occupy the vacant factory owned by the Victor Sewing Machine Company.—*Manufacturers' Gazette.*

Harlem, N. Y.—A portion of the new city lighting was awarded to the American Electric Manufacturing Company, and a local company has now been formed, under the name of the American Illuminating Company of Harlem, to put in a plant. This company is now putting in a central station, wires, etc., and will soon be ready to commence operations, beginning probably with a 200-light plant.

They have a way of their own in Russia. A special commission appointed by the Minister of Ways of Communication is about to select the best system of electric train lighting, in accordance with a decision arrived at lately, making the adoption of the electric light compulsory for all passenger trains on the leading lines. In America we are arriving at the same result by different means, but not so hurriedly that we shall fail to derive benefit from the Russians investigations if they are honestly conducted. Perhaps the Russians may send over here to find out how the work is done in America.

Lawrence, Mass.—About a year ago the Arlington Mills Company, of Lawrence, Mass., one of the largest and most important concerns in that city, adopted the American arc light system for lighting the mills. A 300-light plant was installed. These lights have been giving perfect satisfaction to the management, and last week an order was placed with the American Company for an increase of 150 lights.

Sydney, New South Wales.—The company organized in Sydney to put in an American arc light plant is getting everything ready for the installation. The company is capitalized at $500,000, and it is supposed that the plant will be increased to 1,000 lights. Last week an American plant, together with engine, wire and supplies of all kinds for the installation, amounting to about 100 tons, were shipped by steamer from New York.

Santa Rosa, Cal.—A dispatch of recent date from Santa Rosa says: "The Santa Rosa Gas Company, the present owners of the Thomson-Houston electric light plant here, recently purchased the Keith system, and thus secured a monopoly of the the business. To-day advanced rates of 66⅔ per cent. were published and met with much disapproval. To-night a number of lights were cut off, the consumers claiming they could not stand the advance."

West Chester, Pa.—The Edison Electric Illuminating Company have been lighting the streets of the borough of West Chester with 16 c. p. incandescent lamps for two years. The results have been so satisfactory to the council and citizens that last week the council awarded to the company a new contract for three years. Mr. R. T. Cornwell is the president of the company, Mr. D. M. McFarland treasurer, and T. W. Embree superintendent.

Electric Light vs. Torpedoes.—At Newport, R. I., on Oct. 11, a test of the torpedo system was made by an attack on the man-of-war "Atlanta." The attacking force consisted mainly of six steam launches and four row-boats, armed with spar torpedoes. Owing to the successful manipulation of the electric search lights on the "Atlanta," each of the boats was detected on its approach, and under the rules declared *hors du combat*. The sham fight occupied about half an hour.

Corsicana, Tex.—Mr. J. E. Whiteselle, of the Texas Mill and Elevator Company, is running one 30-arc light machine and one 300-light incandescent. He is to put in an additional 100-light incandescent machine. The price for arcs on 10 o'clock circuit is $10; midnight circuit, $15; all night, $16.66. Incandescents on 10 o'clock circuit, $1.50; all night, $2. Hotels and large consumers take Lght under contract at lower rates. Where a single light is put in an office or room the price is $2, no matter what may be the consumption of current.

Newton, Mass.—The Newton Electric Light and Power Com- has recently put into operation at Waterloo, Mass., a system of incandescent street lighting which, it is reported, "is meeting with unqualified approval." Forty 25 c. p. lamps are arranged in series from the Thomson-Houston alternating dynamo, both lamps and wires being attached to iron extensions fastened to the old gas lamp-posts. The same dynamo and wires also supply incandescent lamps, through transformers, for houses and stores four miles distant from the station.

Mansfield, O.—The stockholders of the Mansfield Gas-Light Company and the stockholders of the Mansfield Electric Light and Power Company held their annual elections on Oct. 6. The officers of the gas company are as follows: President, L. A. Strong, vice-president, S. E. Bird; treasurer, Joseph S. Hedges; secretary, W. C. Hedges; superintendent, George S. Harris. The electric light company officers are as follows: President, S. E. Bird; vice-president, John B. Netscher; treasurer, Joseph S. Hedges; secretary, W. C. Hedges; superintendent, George S. Harris.

Milford, Mass.—The Milford Electric Light and Power Company has put 30 Thomson-Houston arc lights into the mill of the Hopedale Elastic Fabric Company, two miles from its station. The service is giving perfect satisfaction. This makes 77 arc lights now being run by the company, of which only 12 are municipal lights. The company also operates a Brush-Swan incandescent system, which maintains 400 lights and furnishes current for two 12 h. p. Sprague motors. Mr. G. M. Greene is president of the company, Mr. J. Allen Rice treasurer, Mr. A. S. Trowbridge secretary.

Port Huron, Mich.—The Excelsoir Electric Light Company, of Port Huron, Mich., has been incorporated with a capital stock of $50,000. This company has ordered two 12 x 12 engines from the Ball Engine Company, of Erie, Pa., which are to be connected by a continuous shaft. The shafting is supported by pedestal pillow blocks, and carries a number of Hill friction clutch pulleys to drive the dynamos direct. By this means any dynamo can be stopped or started at will without stopping the engine or interfering in any way with the other dynamos. This plan of connecting engines together is said to be quite popular, and a great many electric light companies are adopting it.

Indianapolis Jenney Plants.—The Jenney Electric Company of Indianapolis received the following orders for September: A 200-light series incandescent plant for Holton, Kan., and a similar order for Lapeer, Mich.; a 100-light incandescent outfit for Clarksville, Tenn.; an 80-light incandescent plant for the Udell Ladder Works, Indianapolis; 60 arc lights with towers for Berkley, Cal.; 100 arc lights for St. Joseph, Mo.; and a large plant for the Hall Safe and Lock Company, Cincinnati, where 100 arc lights and 200 incandescents will be used. The company has added another room, 50 × 140 feet, for machinery, to its factory.

Houghton, Mich.—The Peninsula Electric Light and Power Company, of Houghton, Mich., was organized Oct. 1, 1887, with a capital stock of $50,000 in 2,000 shares of $25 being the continuation of the J. R. Dee Electric Light and Illuminating Company. The officers are: Jay A. Hubbell, president; J. B. Sturgis, secretary and treasurer; and J. R. Dee, general manager. The company is now operating one 45 and three 30 light Thomson-Houston machines, and has several series incandescents of 16, 32 and 65 c. p. working with splendid success on its arc circuits. It has one 10 × 12 Porter engine from Syracuse, N. Y., and one Ball 10 × 12.

APPLICATIONS OF POWER.

Chattanooga, Tenn.—It is proposed to form a company at Chattanooga to put in an electric railway.

Stockton, Cal.—Several electric railway projects are being pushed, and a franchise has been granted for a road from Lodi to Woodbridge.

Buffalo, N. Y., is to have a trial of electric motors on its Main street line of horse cars. It will be running there before the end of the year.

Cleveland Motors.—It is reported that a large factory is to be erected in Jersey City where Cleveland motors will be made by the Nyland Company of New York.

Woonsocket, R. I.—A street railway expert writing from the above place says that the running of the Bentley-Knight road there is "without exception the finest I ever saw."

Nevada City, Cal.—The Nevada County Land and Improvement Company has petitioned for a franchise for an electric railway four miles long between Nevada City and Grass Valley.

Providence, R. I.—A large amount of work is being done in Nicholson & Waterman's machine shop at Providence for the Bentley-Knight electric roads on Fulton street and in Allegheny City. The work is such as to indicate very superior construction on the lines in question.

San Jose, Cal.—A special dispatch from San Jose of Oct. 6 says: "The six months allowed the electric railroad in which to complete the work will expire next Wednesday, and it looks as though the franchise would be forfeited." It is to be hoped this project will not be dropped.

Impressively Big.—In its account of the electrical exhibition at the American Institute, the New York *Tribune* says: "Even those huge ideal representatives of American steam enginering, the Corliss engines, have sunk into insignificance beside the powerful motors produced by electricians."

Philadelphia, Pa.—The Lombard and South Street Passenger Railway, of Philadelphia, will shortly begin running cars by electricity. One car will be put on for a month as an experiment, and if it is successful more cars will follow. The company has a contract with Mr. William Wharton, who will run the electric cars.

Brainerd, Minn.—The Mississippi Water Power and Boom Company, of Brainerd, now have a Thomson-Houston plant of 30 arc lights, which has just gone into operation. Upon the completion of a dam across the Mississippi River, in about 60 days, the plant will be enlarged and run by water power, as will also the Northern Pacific shops and the street railway, by means of electric motors. Mr. C. F. Kindred is president of the company, Mr. F. B. Thompson secretary, and Mr. J. N. Nevers treasurer.

The Baxter Motor has from the first been in demand, and now the Baxter Electric Manufacturing and Motor Company has to build a new factory, for which it has bought a block of 10 acres in Baltimore. The factory will cover 260 × 300 feet, and ground has already been broken. The location is in the eastern part of the city, near the P. W. & B. Railroad. The factory will when in full running order give employment to 700 men. Mr. T. McCoubray, Jr., will represent the company in New York and its vicinity.

Woonsocket, R. I.—The contract for erecting the new electric light and power station for the Woonsocket Electric Light and Power Company, Woonsocket, R. I., has been awarded to the Jarvis Engineering Company, Boston. They will use 1,000 h. p. of Armington & Sims engines and the boiler will be set with the Jarvis setting. The company will furnish power for the new electrical railroad, using the Bentley-Knight system. The lights and motors are from the Thomson-Houston Company. This will be one of the largest electrical plants in New England.

Wilkesbarre, Pa.—The Wilkesbarre & Suburban Street Railway Company has been incorporated at Wilkesbarre, by H. H. Derr, J. W. Hollenback, B. H. Carpenter, A. C. Robertson and others, with a capital stock of $40,000. It is the purpose of the company to run a "belt" line from the centre to the northern portion of the city, and the road will be in operation by Dec. 1. The Sprague electric system will be used, with overhead conductors. The local firm of Carpenter, Robertson & Co., have received the contract for the cars and the electrical equipment.

Woodland, Cal.—A dispatch from Woodland of Oct. 6 says: The owners of our street railroad franchise, W. M. Coward and J. D. Lawson, came up last night from San Francisco, where they had been for the purpose of receiving estimates and information regarding the proposed street railroad. They have been examining a new electric motor system resembling a cable road somewhat. It is called the "Telepherage Electric" system. It is likely the road will be built on that plan, as the company controlling the system will guarantee it and take stock in the enterprise.

Milford, Mass.—The Milford street railway is fast on its way to consummation. In addition to the steps recently published, W. H. Cook, C. W. Snippen, of Milford; General Draper, of Hopedale, and the other projectors of the enterprise have forwarded an application for a charter, describing the location as from the machine shop, Hopedale, through Adin street and Main street in Milford to the Norcross Bros.' quarries. A spur track will connect the main line with the railway stations. The capital stock is $50,000, mainly held by the gentlemen interested in the Milford Electric Light and Power Company and the Milford Water Company.

Attleboro, Mass.—Several gentlemen have subscribed the amount required by law to start the enterprise, and have organized as the Attleboro, North Attleboro and Wrentham Street Railway Company, and chosen the following directors: H. G. Bacon, Peter Nerney, C. L. Watson, J. E. Draper, H. M. Daggett, Jr., W. M. Fisher, F. L. Burden. The route will be from Park street railroad crossing in Attleboro, through Park, North Main, North avenue, High, Elm, Washington and South streets to School street in Plainville, a distance of six miles. It will not be many months before this mode of transit will be in use between Attleboro and Plainville.

Brooklyn, N. Y.—The Van Depoele Company have equipped a six mile road from the Alabama junction of the Brooklyn elevated road out to Jamaica, and passing several of the large cemeteries. It reaches also a large and growing district around Hampstead Hill and Morris Park. A 100 h. p. generator has been installed at the station, midway on the line, with a Putnam engine and Bigelow boiler. The road will probably be ready by the end of the month, when the horses will be superseded. The double overhead system is used. There is every promise of a big success electrically and every other way. The road is free from grades and has but few curves. At present it is one of the dustiest tracks on earth, but electricity will remedy all that.

PERSONALS.

Mr. E. H. Johnson is now president of no fewer than six companies.

Ex-Minister Elihu B. Washburne, who died recently, introduced the first postal telegraph bill ever brought before the House of Representatives.

Mr. G. W. Mansfield will, it is understood, be hereafter associated with the Thomson-Houston Company, in connection with their motor department.

Count Mikiewicz has leased the handsome house in Washington formerly occupied by Secretary Manning, and will stay there with his family for at least a year.

Mr. D. H. Bates continues a personage of much interest in telegraphic circles. His contract with the Baltimore & Ohio Company does not expire until Jan. 1, 1889.

Mr. Justice Grove, the inventor of the Grove battery, and an ex-president of the British Association, has just retired from the English bench after sixteen years of service. He is 77 years old.

Mr. Hubert Howson is to represent the well-known firm of Howson & Howson, late Howson & Sons, of Washington and Philadelphia, in New York City, with offices in the Potter building.

Dr. Amory, president and general manager of the Brookline (Mass.) Gas Company, becomes the manager of the New England department of the American Electric Manufacturing Company, retaining his gas connection and office.

Mr. C. H. W. Biggs, the editor of the London *Electrician*, has, we learn with regret, resigned his position. He is succeeded by Mr. W. H. Snell, his associate, who will continue to conduct the paper on the lines that have given it prominence and influence in the past.

Thomas A. Edison, the inventor, is an inveterate pipe-smoker. It is said that he has invented a new kind of pipe which will make a sensation in the world of puffers. There is no electricity about it, but the inventor hopes it will come into current use.—*N. Y. World.*

Mr. W. I. Wark, of the Empire City Electric Company, has resigned his position to take the managership of the St. Louis Electrical Supply Company, in which the well known optical firm of A. S. Aloe & Co., of that city, are interested, it being in fact the outcome of their large and growing business in electrical goods and apparatus.

Mr. C. A. Richards, the president of the Metropolitan Railroad Company in Boston, expresses to a reporter of the Boston *Globe* his satisfaction with the general results of electric storage cars tests. He regards electric cars as superior to horses, cable and elevated steam roads, and says that they will prevent street blockades. He sees in them "possibilities for the future of the street car business of the country that must revolutionize the entire system of conducting it by means of horses," and adds: "Is it not a grand and satisfying thing that our electricians have accomplished all that I have been describing to you?"

Secretary J. B. Hall, Jr., of the Evansville, Ind., Gas Light Company, has patented a device, known as Hall's electrical meter indicator. It is run by the meter movement, and by an electric arrangement shows on a dial placed at a convenient situation in any part of a building the quantity of gas passed each minute by the meter. Gas men all understand the benefits to be derived from consumers reading their own meters, which they will not do. Secretary Hall's patent will guarantee this. The idea is certainly a good one, seems feasible, and it is to be hoped Mr. Hall will meet with success in introducing his patent.—*Light, Heat and Power.*

Mr. G. M. Phelps, Jr., was the presiding officer at the meeting of the Twilight Club, at the Hotel Hungaria, on Oct. 13, when the subject of the evening was: "What shall be done with the battle flags." The admirable discussion was participated in by two other gentlemen also well-known in electrical circles, Gen. C. H. Barney and Capt. H. R. Garden, who went through the war, the former on the Northern side and the other on the Southern, and who both had some very forcible and happy addresses to make, advocating that the flags should be deposited in some suitable place in Washington, not as the sectional trophies of either side, but as national memorials of valor.

Mr. T. L. Clingman.—An old man, who wears an aged beaver and is very mild mannered but quite loquacious, is to be seen in public places almost every evening, and all who know him speak to him with great respect. He is one of the ten surviving Southern Senators who went out of the United States Senate to cast their lots with the Confederacy in 1861. He is Thomas L. Clingman, who used to represent North Carolina in the Senate, and who once received the warmest praise from the aged Nathaniel Mann, whose record of continuous service in Congress is longer than that of any other man. Mr. Clingman was a fire eater in early life, but is the gentlest of men now, and believes he has discovered a mineral which is far better for electric lights than the carbon points.—*N. Y. Sun.*

Mr. Edward Weston was recently interviewed in his fine laboratory at Newark, N. J., by a New York *Herald* representative, who was somewhat surprised when, by the intervention of a couple of thermopiles applied to the brain and a small motor carrying a drill, Mr. Weston made him think a hole through a half inch plank. Mr. Weston also showed him the result of some of his recent chemical investigations and made the interesting statement that he had devoted his energies of late to the electric railway problem, and thought he had reached finality in some very important principles not heretofore made known. Mr. Weston's work in this, as in other departments, will be received with the greatest interest and attention. He is quoted as saying of his new departure: "It differs from any of the existing methods of operating electric motors on railway lines. It is not merely a scientific possibility, but a practical, commercially available and economical solution of the problem of electric railway motors."

MISCELLANEOUS NOTES.

New York Subways.—It is said that there are now 160 miles of subway duct laid in this city.

Galvanic Batteries.—The National Galvanic Battery Company, of New York, has been incorporated by H. Walters and others, with a capital stock of $1,000,000.

Shultz Belting.—The Shultz Belting Company, of St. Louis, Mo., have just put in a new power belt press, 62 inches wide, and can now make patent fulled leather belts five feet in width.

Electric Cure.—The M. K. Elliot Electric Cure Company has been incorporated at Chicago by C. T. Elliot and C. Brown with a capital stock of $10,000 to make and sell "bottled batteries."

Beattie Zincs.—The Beattie Battery, Zinc and Electrical Company, of Fall River, Mass., is making preparations for starting up. Already a ton of mercury has arrived from California, a quantity of zinc from Tennessee, and a carload of spelter from Pennsylvania.

Perfecting the Phonograph.—The report has been circulated in the daily papers that Mr. Edison has perfected his phonograph and put it in the hands of a company for manufacture and sale. This is not correct, though it indicates the probable course of events in the near future.

Produce Exchange Frivolities.—The big thing on the Produce Exchange the other day was not wheat or pork or flour. "It was an electricity-making machine that was operated by turning a crank, and sent out a current strong enough to tie experimenting brokers up into particularly tight knots. Business was dull, and for half an hour the machine drew most of the crowd out of the wheat pit."

Cornell University.—The Cornell *Sun* says that the equipment at the University, in the line of electrical engineering, bids fair to become, if it is not so already, the most complete in this country. It now includes Edison, Gramme, Mather, Weston and Westinghouse dynamos and a number of motors, as well as a great variety of measuring apparatus and other instruments. The department is receiving the special attention of Profs. Thurston, Nichols, Van Vleck, Morris and Smith.

The Gaynor Electric Company, of Louisville, Ky., of which we gave particulars recently, is organized to carry on a general electrical business, including the sale of its rapid system of fire alarm, its rapid telegraph service, arc and incandescent plants, electric motors, storage batteries and all the new devices. The capital stock of the company is $200,000. Mr. J. H. Sutcliffe is the president, Mr. J. J. Barret vice-president, Mr. T. F. Gaynor superintendent, and Mr. E. D. Hobbs, Jr., secretary and treasurer.

National Electric Light Association.—The Executive Committee of the Association, Mr. S. A. Duncan chairman, has issued an appeal to the members for $2,500, of which $1,000 is required to print the proceedings of the Detroit, Philadelphia and Boston conventions, and $1,500 to push through Congress the bill reported by the committee on patent legislation, providing for a patent commission to investigate the subject, for a revision of the patent laws, and reform in the Patent Office. It is thought better to raise this amount by voluntary contribution of the members than by assessment.

A Modern Dragon.—The great dragon drawn in a recent Chinese procession in San Francisco by six Chinamen is described as follows: From a point just under the mansard roof of the dragon's head to within three feet of his tail, there is a network of electric wires, all communicating with a complicated machine located in close proximity to his lower jaw and out of sight. One of the men who march under it, at a given signal, touches an ebony button, and the electricity causes the huge jaws to fly open, disclosing a mouth like a tunnel, filled with frightful fangs and darting tongues of fire.

The First Lightning Rod.—If we are to believe an Austrian paper, says *La Lumiere Electrique*, the first lightning rod was not constructed by Franklin, but by a monk of Seuftenberg, in Bohemia, named Prokop Diwisch, who installed an apparatus the 15th of June, 1754, in the garden of the curate of Prenditz (Moravia). The apparatus was composed of a pole surmounted by an iron rod supporting twelve curved up branches, and terminating in as many metallic boxes, filled with iron ore and closed by a boxwood cover, traversed by 27 sharp iron points, which plunged at their base in the ore. All the system was united to the earth by a large chain. The enemies of Diwisch, jealous of his success at the court of Vienna, excited the peasants of the locality against him, and under the pretext that his lightning rod was the cause of the great drought, they made him take down the lightning rod which he had utilized for six years. What is most curious is the form of this first lightning rod, which was of multiple points like the one which M. Melsen afterward invented.

BUSINESS NOTICES.

Jordan & Gottfried, 208 Canal St., N. Y., carry a complete stock of iron and brass machine and wood screws, bolt cap and set screws, taps, dies, files, twist drills, brass and rubber tubing, rod and sheet copper, brass, German silver, steel and iron wire, shafting, tools, etc.

The Detroit Lubricator Company, of 129 Griswold street, Detroit, has issued a circular, explaining the situation in the sight feed lubricator business, and stating that the old agreement between itself and the Seibert Cylinder Oil Cup Company, providing that each should have the right to make and sell under its own patents, remains in force, and has in no way undergone change or impairment.

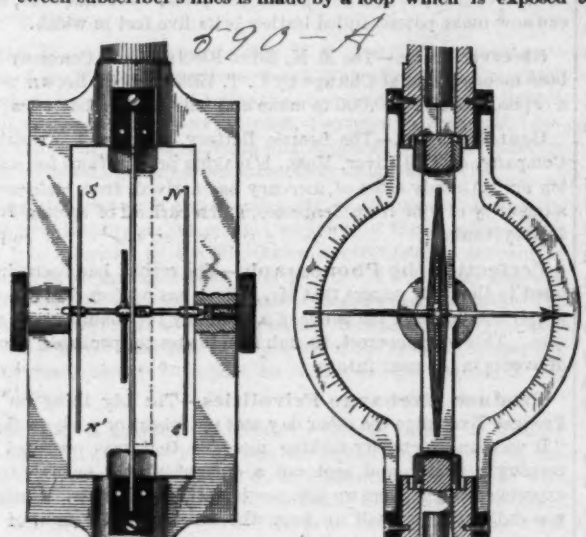
OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED OCTOBER 18, 1887.

371,536. Brush Shifter for Dynamo Electric Machines and Motors; E. H. Amet, Chicago, Ill., Assignor to himself and H. A. Streeter, of same place. Application filed April 9, 1887. A supplemental brush is used in connection with a magnet for shifting the main brushes to suit the amount of work on the external circuit.

371,551. Mechanical Telephone; J. W. Colby, of Penacook, N. H., Assignor of one-fourth to Charles A. Cotterill, of Washington, D. C. Application filed April 11, 1887. This telephone contains a sound wave deflector, consisting of one or more discs having a series of radial leaves inclined to the general plane of the disc.

371,555. Anti-Induction Device; James Curran, Portland, Ore. Application filed April 13, 1887. Connection between subscriber's lines is made by a loop which is exposed to



371,720. ELECTRICAL INDICATOR.

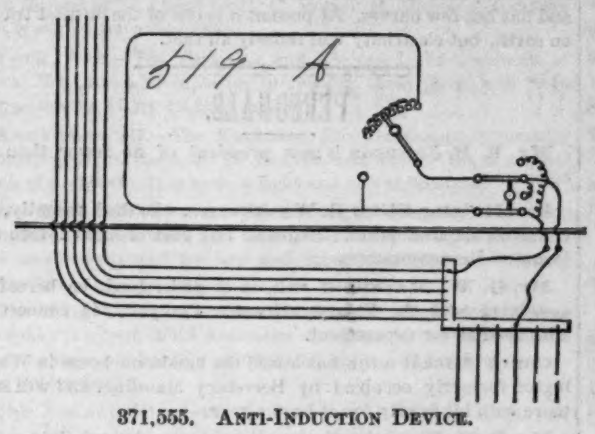
the influence of the same disturbing source as that which affects the telephone circuit. See illustration.

371,557. Anti-Induction Device; S. C. Drew, Boston, Mass., Assignor to the American Telephone Improvement Co., of Maine. Application filed Aug. 7, 1886. An induction coil is placed at the receiving station whose primary is in the main line circuit, the currents from the sending station passing through it to ground. The receiver is in circuit with the secondary coil, and receives a message by induction from the primary coil.

371,559. Electric Meter; R. N. Dyer, East Orange, N. J. Application filed Oct. 21, 1886. A magnet controlling the speed of the register and demagnetizng coils in the main line, acting to decrease the force of the said magnet and to increase the speed of the register when more lights are switched on.

371,570. Socket and Key for Incandescent Lamps; J. J. Fisher, Allegheny, Assignor to the Westinghouse Electric Company, of Pittsburgh, Pa. Application filed March 1, 1886. The key is connected with a spring, which holds the contact pieces either apart or together, and the lamp may be inserted and locked into its socket without any turning.

371,626. Device for Indicating Life in Buried Persons; Carl Redl, Vienna, Austria, Hungary. Application filed March 16, 1887. Electric circuits are arranged in connec-

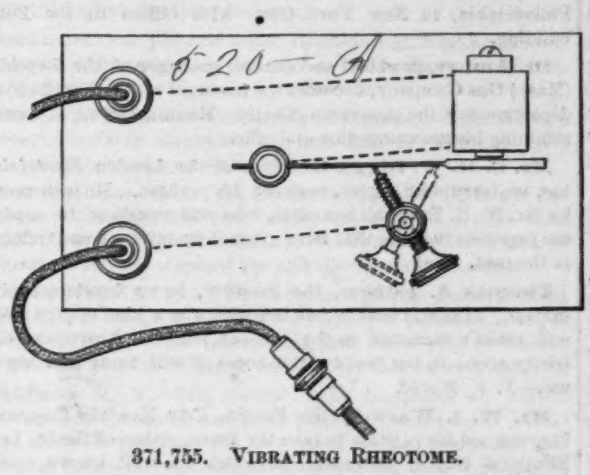


371,555. ANTI-INDUCTION DEVICE.

tion with coffins, so that the person interred may, if alive, start an alarm.

371,640. Electric Alarm and Recorder for Oil Presses; E. W. Thompson, of Charlotte, N. C., Assignor to the Southern Cotton Oil Company, of Camden, N. J. Application filed April 5, 1886. Electrically operated mechanism for registering the operations of presses.

371,655. Electro-Magnetic Brake Apparatus; G. T. Woods, Cincinnati, O., Assignor to the Woods Electric Com-



371,755. VIBRATING RHEOTOME.

pany, of same place. The rotative force of the wheels is utilized to brake the same by means of electrically operated devices which are connected therewith.

371,664. Electric Forceps; J. Brannon and W. E. Stone, Denver, Colo. Application filed Nov. 29, 1886. The legs of a pair of forceps are placed in an electric circuit, which is completed through the part or body to which the forceps are applied.

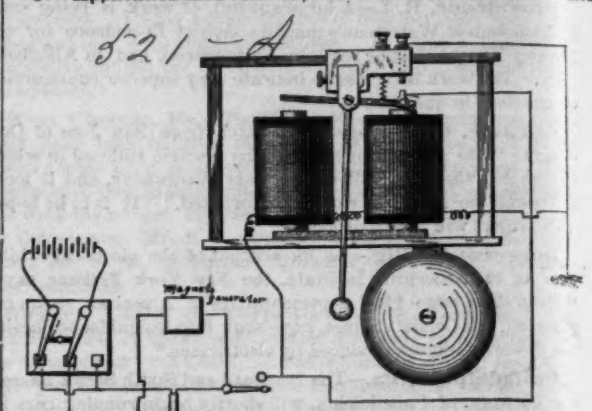
371,670. Railway Signal; E. M. Chase, of Boston, Mass. A clockwork is set in motion by an electric circuit operated by a moving train. The clockwork rings an alarm bell.

371,740. Electrical Indicator; M. Waddell, New York N. Y. Application filed March 19, 1887. Two oppositely magnetized needles are pivoted together between the divisions of a split or divided conductor. See illustration.

371,752. Electric Call or Signal Apparatus; G. W. Foster, Galveston, Tex. Application filed January 13, 1887. The invention consists in providing means whereby a polarized electric bell capable of being operated rapidly by currents of alternating polarity may also be operated by constant currents of the proper polarity. See illustration.

371,755. Vibrating Rheotome; J. R. Hard, New York, N. Y. Application filed June 14, 1887. Improved means for holding the vibrating spring of a rheotome, also improved contact screw and holder for same, for varying the rate of vibration. See illustration.

371,757. Telephone Holder; A. L. Hott, of Cincinnati, O. Application filed June 29, 1887. This is a bracket which



371,752. ELECTRIC CALL OR SIGNAL APPARATUS.

holds the receiver conveniently to the ear so that a person using it may have the free use of both hands.

371,808. Joint for Lead-Covered Cables; R. S. Waring, Pittsburgh, Pa. Application filed October 1, 1886. Instead of the usual wipe joint a sectional shield is employed to make joints good.

371,810. Electric Circuit Connection; S. Heffner and J. H. Phillips, of Pottsville, Pa. Application filed July 19, 1887. Springs are used behind buttons on the end of the conductors to force them together.

371,876. Fire Alarm Telegraph; C. Burgher, Boston, Mass., Assignor to the Automatic Fire Alarm and Extinguisher Co. (Limited), of New York, N. Y. Application filed June 12, 1886. A normally closed metallic circuit, having branches, a relay and a circuit changer therein; one branch having its retaining magnet and the other the actuating magnet and transmitting device.

371,893. Electrical Distribution and Charge of Secondary Batteries; F. King, of Fulham, County of Middlesex, England. Application filed March 15, 1887. The charge and discharge of storage batteries is accomplished at the proper times without interruption of the charging or discharging currents.

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